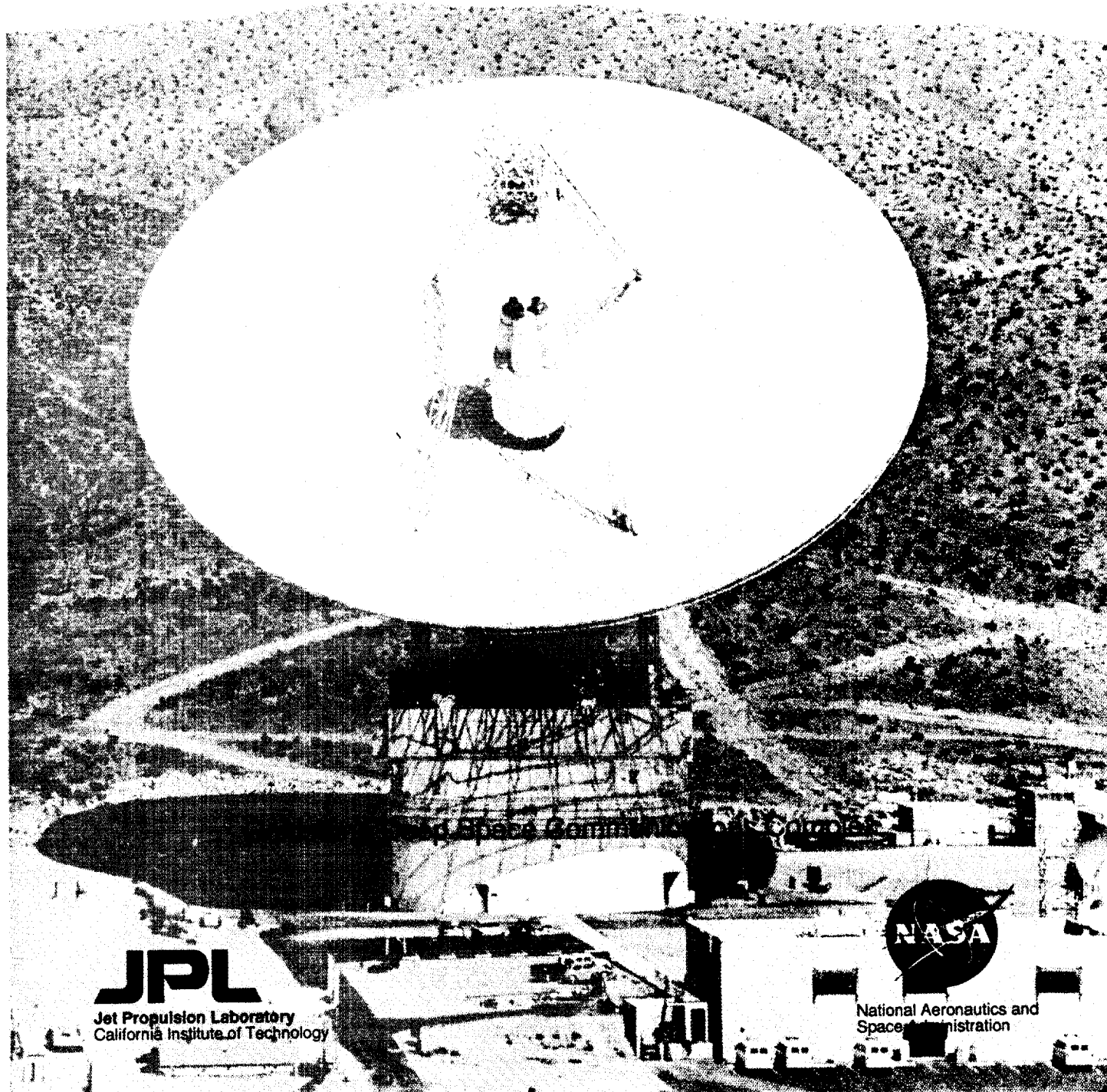


Environmental Projects: Volume 17

Biological Assessment, Opinion, and Final Report:
New 34-Meter Beam-Waveguide Antenna (DSS 24)
at Apollo Site



March 1, 1996

TO: RECIPIENTS OF GOLDSTONE ENVIRONMENTAL PROTECTION REPORTS

The Telecommunications and Mission Operations Directorate (TMOD) at JPL is publishing a series of reports that describes several environmental projects at the Goldstone Deep Space Communications Complex (GDSCC). A report will be issued as each project in the Goldstone Environmental Protection Program is completed.

The three-fold objective of these reports is:

- 1) To provide Goldstone Maintenance and Operations personnel with details of task implementation.
- 2) To serve as a basis for the documentation of environmental activities at Goldstone, as required by regulatory agencies.
- 3) To provide prototype samples of reports that can be referred to by other organizations that may be planning similar environmental protection and compliance projects.

The published TMOD reports include the following:

Volume Number	Compliance Task	Approximate Issue Date
1	Polychlorinated Biphenyl (PCB) Abatement Program (GDSCC)	Issued
2	Underground Storage Tanks - Compliance Program (GDSCC)	Issued
3	Environmental Compliance Audit: Final Report (GDSCC)	Issued
4	Asbestos Survey (GDSCC)	Issued
5	Part One: Study of Subsurface Contamination (GDSCC) Part Two: Guide to Implement Environmental Compliance Programs	Issued
6	Environmental Assessment: New 34-M Antenna at Venus Site (GDSCC)	Issued
7	Environmental Resources Document (GDSCC)	Issued
8	Modifications of Wastewater Evaporation Ponds (GDSCC)	Issued
9	Construction of Hazardous Materials Storage Facilities (GDSCC)	Issued
10	Environmental Assessment: New 34-M Antenna at Apollo Site (GDSCC)	Issued

Environmental Projects: Volume 17

Biological Assessment, Opinion, and Final Report: New 34-Meter Beam-Waveguide Antenna (DSS 24) at Apollo Site

Goldstone Deep Space Communications Complex

The research described in this publication was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement by the United States Government or the Jet Propulsion Laboratory, California Institute of Technology.

ABSTRACT

The Goldstone Deep Space Communications Complex (GDSCC), located in the Mojave Desert about 64.5 km (40 mi) north of Barstow, California, and about 258 km (160 mi) northeast of Pasadena, California, is part of the National Aeronautics and Space Administration's (NASA's) Deep Space Network (DSN), the world's largest and most sensitive scientific telecommunications and radio navigation network. The Goldstone Complex is managed, technically directed, and operated for NASA by the Jet Propulsion Laboratory (JPL) of the California Institute of Technology in Pasadena, California.

Activities at the GDSCC support the operation of nine parabolic dish antennas situated at five separate locations known as sites. Four sites are named Mars, Echo, Apollo and Venus. The fifth site, named Gemini, was recently transferred to NASA/JPL from the U.S. Army and has two parabolic dish antennas.

Each of the GDSCC sites has one or more antennas. The antennas, with their ancillary equipment and installations, are called Deep Space Stations (DSSs).

This report deals with the Biological Assessment, Biological Opinion and Final Report on the construction at the Apollo Site of a new, high-efficiency, 34-meter (111.6 ft), multifrequency beam-waveguide antenna. This new antenna, initially designated as DSS 18 and now designated as DSS 24, is of a design similar to the DSS 13 34-m antenna previously constructed at the Venus Site.

In accordance with the Endangered Species Act of 1973, Section 7(c), a Biological Assessment must be conducted and a Biological Opinion, with terms and conditions, must be rendered by the U.S. Department of the Interior before construction begins on any federal project that may affect any flora or fauna designated either as an endangered or a threatened species. In addition, during construction, biological monitoring is conducted to insure compliance with the provisions of the Biological Opinion. Upon completion of the construction, a Final Report is filed with the U.S. Department of the Interior concerning observations and biological impacts.

In 1992, JPL retained the Battelle Pacific Northwest Laboratories (BPNL) to conduct a survey to determine whether a biological species given threatened status (the desert tortoise) or two biological species given candidate threatened status (the Mojave ground squirrel and the Lane Mountain milk vetch) by the U.S. Fish and Wildlife Service may occur in the DSS 24 construction area.

This present volume is a summary and record of the Biological Assessment, the U.S. Department of the Interior's Biological Opinion and the final Biological Concurrence by the U.S. Fish and Wildlife Service.

The BPNL Biological Assessment found that the desert tortoise and the Mojave ground squirrel could be affected by disturbance of the land in the construction project, but no significant danger exists to these two biological species if site workers are alerted to and are educated about their presence. No stands of Lane Mountain milk vetch were observed in the surveyed construction area. The U.S. Department of the Interior issued a Biological Opinion to mitigate, to minimize and to control any possible deleterious effects to the desert tortoise and the Mojave ground squirrel. The U.S. Fish and Wildlife Service and the California Department of Fish and Game both issued a Biological Concurrence that JPL, indeed, had satisfied all environmental criteria for the preservation of threatened species involved in the construction of the DSS 24 antenna.

GLOSSARY

BLM	U.S. Bureau of Land Management
BPNL	Battelle Pacific Northwest Laboratories, Richland, Washington
CDFG	California Department of Fish and Game
CEPA	California Environmental Protection Agency
CHIA	Cumulative Habitat Impact Analysis
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
DSCC	Deep Space Communications Complex
DSN	Deep Space Network
DSS	Deep Space Station
EA	Environmental Assessment
FEMA	Federal Emergency Management Agency
ft	foot (feet)
FWS	United States Fish and Wildlife Service
GCF	Ground Communications Facility
GDSCC	Goldstone DSCC
HEF	High-Efficiency (Antenna)
JPL	Jet Propulsion Laboratory, Pasadena, California
km	kilometer(s)
m	meter(s)
MBGA	M. B. Gilbert Associates, Long Beach, California
MBS	Mojave Base Site (Goldstone)
mi	mile(s)
MSL	Mean Sea Level
MTF	Microwave Test Facility
NAS	National Audubon Society
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NOCC	Network Operations Control Center
NTC	National Training Center (U.S. Army)
OSHA	Occupational Safety and Health Act
ppm	parts per million
R&D	Research and Development
SEDAB	Southeast Desert Air Basin
SETI	Search for Extraterrestrial Intelligence
STS	Space Transportation System (Space Shuttles)
TDS	Total Dissolved Solids
TMOD	Telecommunication & Mission Operations Directorate (JPL)
UST	Underground Storage Tank
UTM	Universal Transit Marker(s)
VLBI	Very Long Baseline Interferometry
W	watt(s)

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SECTION I

INTRODUCTION

A. BACKGROUND OF A BIOLOGICAL ASSESSMENT CONCERNING CONSTRUCTION OF DSS 24 AT THE APOLLO SITE

The Goldstone Deep Space Communications Complex (GDSCC) is located in the Mojave Desert about 64.5 km (40 miles) north of Barstow, California, and about 258 km (160 miles) northeast of Pasadena, California, where the Jet Propulsion Laboratory (JPL) of the California Institute of Technology (Caltech) is located.

The GDSCC is part of the National Aeronautics and Space Administration's (NASA's) Deep Space Network (DSN). The DSN is the world's largest and most sensitive scientific telecommunications and radio navigation network.

The GDSCC is managed, technically directed, and operated for NASA by JPL in Pasadena, California. A detailed description of the GDSCC is presented in Section II of this report.

At present, activities at GDSCC support the operation of nine parabolic dish antennas situated at five separate locations known as sites. Four sites are named Mars, Echo, Apollo and Venus. The fifth site, named Gemini, recently transferred to NASA/JPL from the U.S. Army, has two parabolic dish antennas.

These antennas, along with their ancillary equipment and installations, are called Deep Space Stations (DSSs). There now are nine DSSs at the GDSCC: one each at the Echo and Venus Sites, two each at the Mars and the Gemini Sites, and three at the Apollo Site.

A sixth site, known as the Mojave Base Site, while part of the GDSCC, is not part of the DSN. It was previously involved in activities of the National Oceanic and Atmospheric Administration (NOAA), but these activities have been terminated as of May 1993.

Originally, the Apollo Site had two parabolic dish antennas: a 26-meter (85 ft) antenna known as DSS 16 and a 9-meter (29.5 ft) antenna designated as DSS 17. The 26-meter antenna originally was constructed in 1965 by NASA's Goddard Space Tracking and Data Network to support the manned Apollo missions to the moon. Both the 26-meter and the 9-meter antennas now are used to support the Space Transportation System (STS, Space Shuttles) and satellites in both low- and high-Earth orbits (Figures 1 and 2).

At present, a third antenna at the Apollo Site, designated DSS 24, has been constructed. It is a new, 34-meter (111.6 ft), high-efficiency, beam-waveguide, multifrequency antenna that will replace the functions of the aging, 34-year-old, DSS 12 34-meter antenna now operating at the Echo Site. The old DSS 12 antenna was constructed in 1961.

The new DSS 24 antenna at the Apollo Site will operate in the present and future deep-space frequency bands with significantly increased performance and efficiency.

Three additional antennas are to be constructed at the Apollo Site: DSS 25 and DSS 26, both at 34-meters (111.6 ft), and DSS 23 at 11-meters (36 ft).

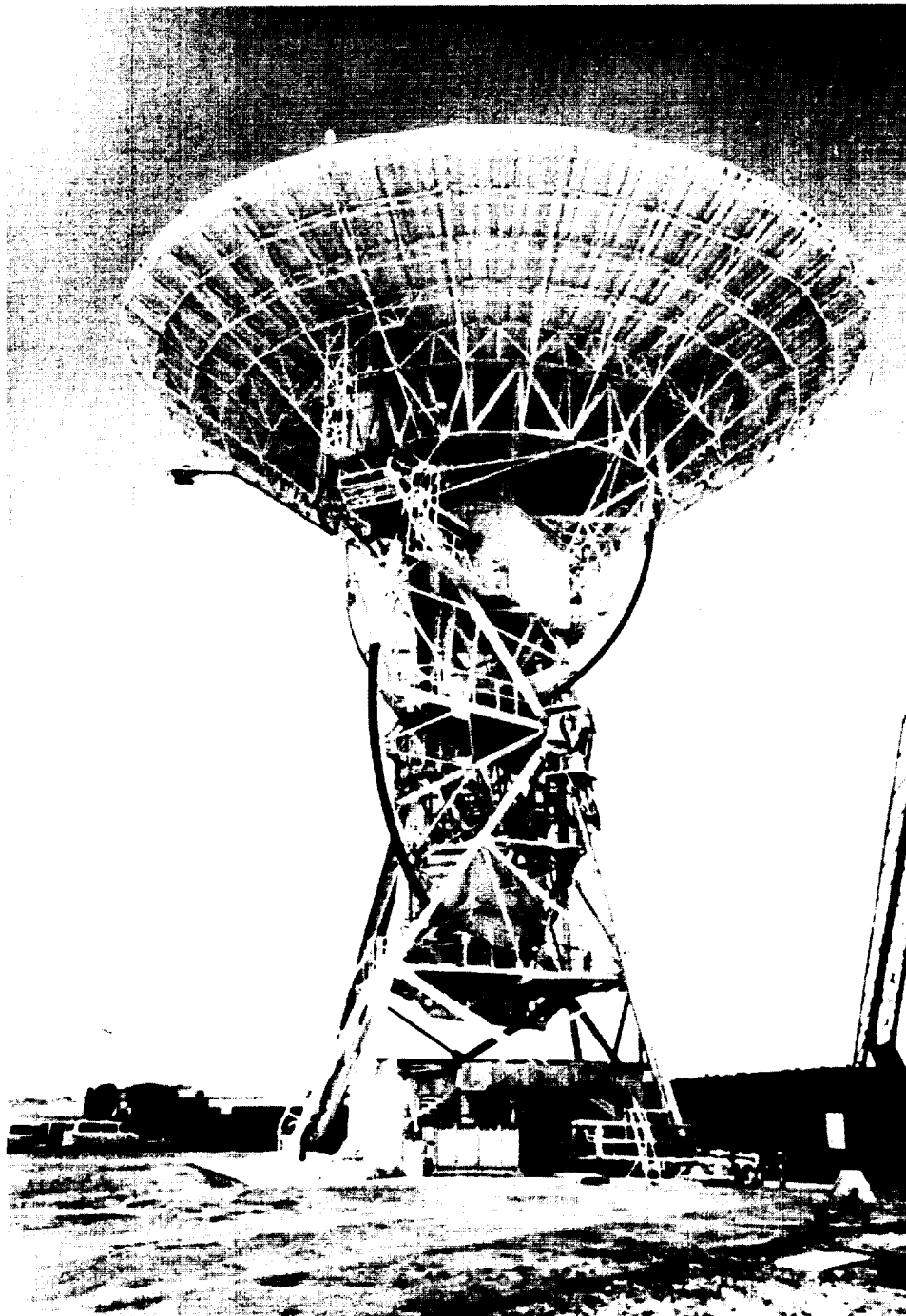


Figure 1. Apollo Site: DSS 16, a 26-Meter Antenna



Figure 2. Apollo Site: DSS 17, a 9-Meter Antenna

Before construction of the 34-meter DSS 24 antenna could begin, in accordance with the Endangered Species Act of 1973, Section 7(c), a Biological Assessment was required to determine whether the construction of this federal project would imperil any endangered or threatened biological species existing within or near the construction area.

Thus, at an early planning stage of the new antenna, JPL sent a letter dated 12 December 1991 to the U.S. Fish and Wildlife Service (FWS) to provide a list of any endangered or threatened biological species that may be found in the vicinity of the Apollo Site at the GDSCC. In a return letter dated 20 December 1991, the FWS indicated one threatened species, the desert tortoise (*Gopherus agassizii*) and two candidate threatened species, the Mojave ground squirrel (*Spermophilus mohavensis*) and the Lane Mountain milk vetch (*Astragalus jaegerianus*). The latter also is known as Jaeger's locoweed. Both the letter from JPL to the USFWS and the reply to JPL from the USFWS are contained in Appendix D.

Thus, based upon this exchange of letters, JPL, in 1992, retained the Battelle Pacific Northwest Laboratories (BPNL), Richmond, Washington, to conduct a survey to determine whether any of these threatened or candidate threatened biological species indicated by the FWS occur within or near the construction area.

In the three-day period, January 6-9, 1992, a BPNL field crew conducted surveys of the DSS 24 project area at the Apollo Site looking for signs of the presence of the three biological species.

This present document includes the survey techniques and results discussed in the BPNL report submitted to JPL in July 1992 along with a discussion of the Biological Opinion and monitoring of the construction of the DSS 24 antenna, and the Concurrence by the U.S. Fish and Wildlife Service that the construction of the DSS 24 antenna would have no effect on the desert tortoise.

B. DESCRIPTION OF THE DSS-24 ANTENNA SITE AND FACILITY

A detailed description of the facilities and antennas at the Apollo Site is presented in a previous environmental assessment of the DSS 24 antenna (JPL Publication 87-4, *Environmental Projects: Volume 10, Environmental Assessment: New 34-Meter Antenna at Apollo Site*, Jet Propulsion Laboratory, Pasadena, California, January 15, 1990).¹

The DSS-24 antenna is a high-performance, 34-meter, wheel-and-track type, azimuth-elevation, multifrequency, beam-waveguide antenna located approximately 213 m (700 ft) south-southwest of the DSS 16 26-meter antenna.

The DSS 24 antenna is similar in size to the DSS 15 34-meter Uranus Station antenna located at the Mars Site in the northern portion of the GDSCC and is similar in size and in structure to the DSS 13 34-meter antenna situated at the Venus Site in the southern portion of the GDSCC (Figure 3). Details of these antennas are discussed in JPL Publication 87-4, *Environmental Projects: Volume 6, Environmental Assessment: New 34-Meter Antenna at Venus Site*, Jet Propulsion Laboratory, Pasadena, California, June 15, 1988.

¹ In the Volume 10 publication, the new 34-meter antenna at the Apollo Site is referred to as DSS 18. This number-designation no longer is used, and the antenna now is known as DSS 24.

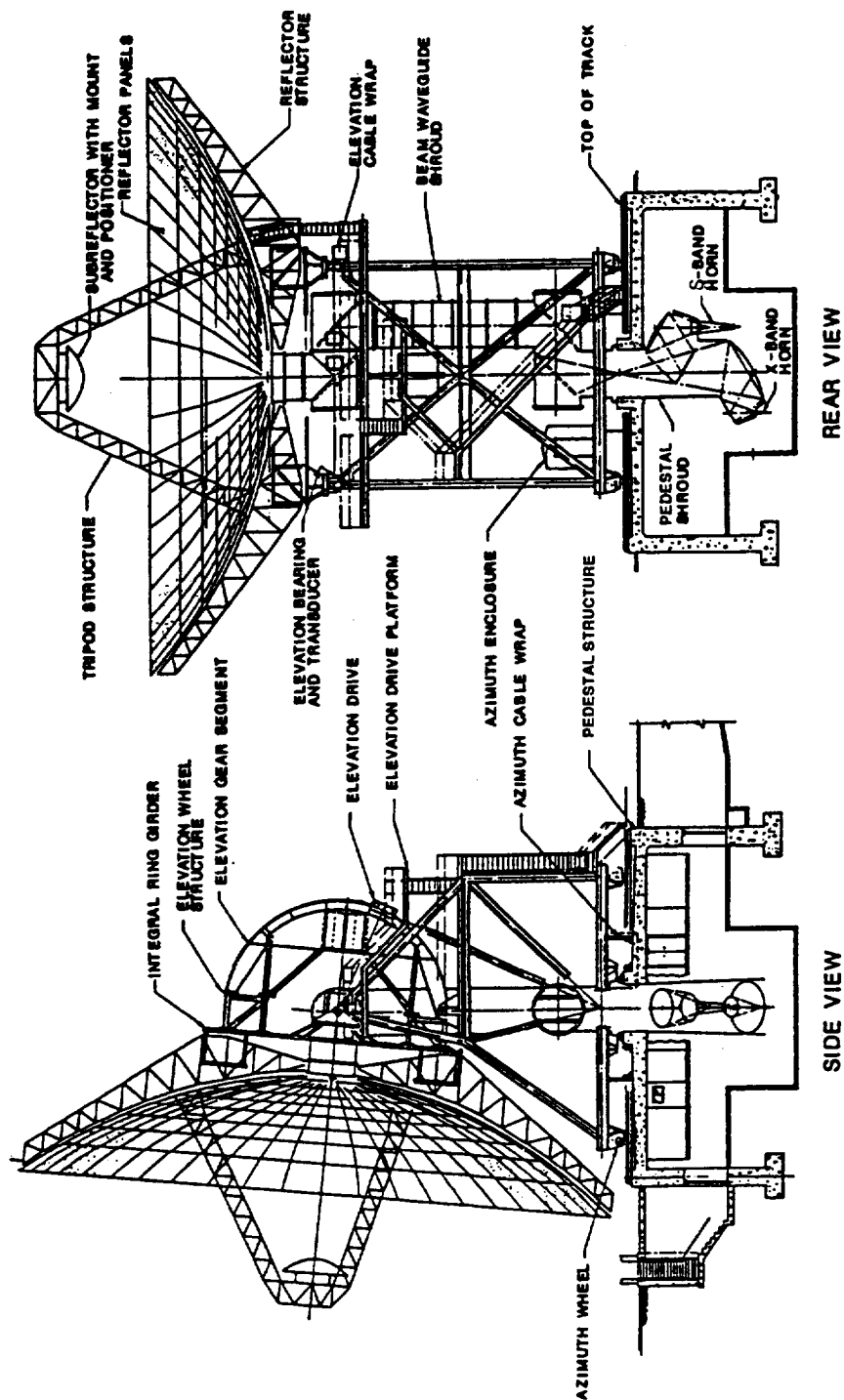


Figure 3. Artist's Drawing of the Two New 34-Meter Antennas at the GDSCC:
DSS 13 at the Venus Site and DSS 24 at the Apollo Site

Constructed on a cement and asphalt pad that is 128 m (420 ft) in diameter, the DSS 24 antenna itself is 34 m (111.6 ft) in diameter. This main antenna pad is surrounded by four additional smaller pads: a 9.1 x 10.4 m (30 x 34 ft) pad is used to support heating, ventilation and air-conditioning equipment; a crane is placed upon a 12.2 x 15.2 m (40 x 50 ft) pad; a heat-exchanger tops a 6.1 x 6.1 m (20 x 20 ft) pad; and a substation is located on a 3.6 x 6.1 m (12 x 20 ft) pad (Figure 4).

Next to the south edge of the maintenance pad are three 3 x 6.1 m (10 x 20 ft) trailers that house various antenna support systems.

A blacktop road, 86.35 m (280 ft) long and 15.2 m (50 ft) wide, runs from the main Apollo Site to the DSS 24 antenna (Figure 4). The figure shows that the total blacktopped area includes both the road and the area between the road and the dashed line to the west (indicated in Figure 4 as running from the crane pad to the main Apollo Site). In addition, an above-ground cable tray and a buried water line run from the main Apollo Site to the new DSS 24 antenna.

The boundary lines for the antenna site encompass a total area of 3.24 hectares (8 acres). Of this area, only 0.8 hectares (2 acres) were disturbed by the construction activities required to build the antenna, support pads, roadway, cable tray and water line.

It is this area of 3.24 hectares (8 acres), within the boundary lines of the new DSS 24 antenna's locale, that was surveyed to determine the Biological Assessment described in this report.

Pictures of the terrestrial scene surrounding the DSS 24 construction site at the Apollo Site are depicted in Figure 5, showing the view towards Goldstone Dry Lake, and Figure 6, the view from the west.

C. BIOLOGICAL OPINION CONCERNING CONSTRUCTION OF THE DSS 24 ANTENNA

Upon completion of the Biological Assessment by BPNL, the report was submitted to the Ventura, CA, office of the U.S. Department of the Interior's Fish and Wildlife Service (see Appendix D). Based upon the Biological Assessment, the USFWS opined that the implementation of the construction of the DSS 24 antenna would not adversely affect the desert tortoise.

The USFWS opinion pointed out that Section 9 of the Federal Endangered Species Act prohibits the "take" of any listed species, such as the desert tortoise. The definition of "take" includes to harass, harm, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct.

If a desert tortoise was found at the DSS 24 construction site, the USFWS indicated that all activities that might result in the "take" of a desert tortoise must cease.

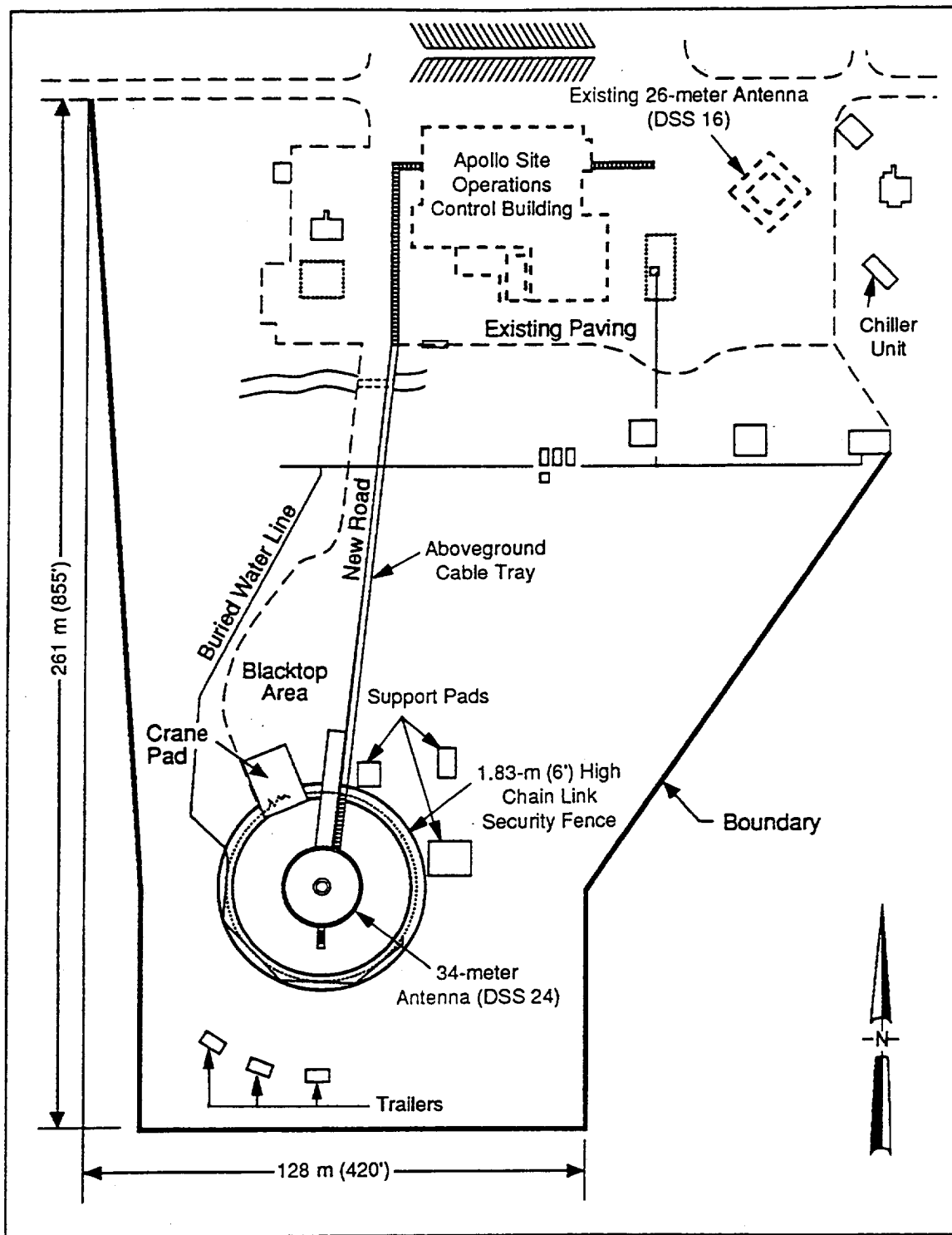


Figure 4. Apollo Site: Site Plan for the DSS 24 34-Meter Antenna



Figure 5. Apollo Site: View Towards Goldstone Dry Lake



Figure 6. Apollo Site: View From the West

D. MONITORING DURING CONSTRUCTION OF THE DSS 24 ANTENNA

To comply with the Biological Opinion of the USFWS concerning the desert tortoise, JPL informed the USFWS that the following seven actions would be taken as part of the DSS 24 construction project.

- (1) Construction personnel were to be briefed on the status of the desert tortoise and the protection measures that were to be taken to reduce any potential impact to this species.
- (2) The antenna construction site was to be fenced-in in a manner to prevent access of desert tortoises to the construction site.
- (3) Overnight parking and equipment storage were to be located within the tortoise-proof fenced area, whenever possible.
- (4) The boundaries of the construction site were to be clearly flagged, and all construction workers were to strictly limit their activities and vehicles to the flagged areas.
- (5) Construction workers were to be told that if a vehicle was parked outside the fenced and flagged area, they were to inspect the ground underneath the vehicle before the vehicle was moved. If a desert tortoise was seen beneath a vehicle, the vehicle was not to be moved until the desert tortoise had left of its own accord.
- (6) During the construction period, trash and food items were to be contained in raven-proof containers, either of metal or heavy plastic with lids that could be secured. The containers were to be removed daily from the construction site.
- (7) If a desert tortoise were to be found on the construction site, activities that might result in the take of a tortoise were to cease immediately and the USFWS was to be contacted. Under no circumstances would JPL try to relocate any desert tortoises found in the construction area without first contacting the USFWS.

E. CONCURRENCE BY THE U.S. FISH AND WILDLIFE SERVICE THAT THE CONSTRUCTION OF THE DSS 24 ANTENNA WOULD HAVE NO EFFECT ON THE DESERT TORTOISE

Based upon the BPNL Biological Assessment and the measures JPL was to take to monitor the antenna's construction, the USFWS concurred that the construction of the antenna would have no effect upon the desert tortoise and that construction could take place.

In addition, the State of California Department of Fish and Game agreed with the USFWS and concurred that the construction project would not adversely impact the desert tortoise, which is a threatened species listed by the State of California as well as the federal government.

Along with their concurrences, both the USFWS and the California Department of Fish and Game included caveats that if any desert tortoises were to be encountered at the construction site, the animals must not be disturbed or relocated without first notifying both agencies. JPL agreed to these caveats.

SECTION II

THE GOLDSTONE DEEP SPACE COMMUNICATIONS COMPLEX

A. LOCATION OF THE GOLDSTONE DEEP SPACE COMMUNICATIONS COMPLEX (GDSCC)

The GDSCC is located in southern California, in a natural, bowl-shaped depression area in the Mojave Desert, in San Bernardino County about 64.5 km (40 mi) north of Barstow, California, and about 258 km (160 mi) northeast of Pasadena, California, where JPL is located.

As indicated in Section I, the GDSCC is part of NASA's Deep Space Network (DSN), the world's largest and most sensitive scientific telecommunications and radio navigation network. The GDSCC is managed, technically directed, and operated for NASA by JPL.

The 135-km² (52-mi²) GDSCC lies within the western part of the Fort Irwin Military Reservation (Figure 7). A Use Permit for the land was granted to NASA by the U.S. Army. The GDSCC is bordered by the Fort Irwin Military Reservation on the north, east, and southeast; the China Lake Naval Air Warfare Center on the northwest; and the State and Federal lands managed by the U.S. Bureau of Land Management (BLM) on the south.

B. FUNCTIONS OF THE GDSCC

After the Space Act of 1958 had accelerated U.S. plans and programs for space exploration, JPL initiated construction work at Goldstone to build the first tracking station of what is now known as the DSN. Thus, for almost four decades, the primary purpose of the DSN has been and continues today to be the support of the tracking of both manned and unmanned spacecraft missions and providing instrumentation for radio and radar astronomy in the exploration of the solar system and the universe.

Over the years, the DSN has become a world leader in the development of low-noise receivers; tracking, telemetry, and command systems; digital signal processing; and deep-space radio navigation.

The basic responsibilities of the DSN are to receive telemetry signals from spacecraft, to transmit commands that control the various spacecraft operations, and to generate the radio navigation data to locate and guide the spacecraft to their destinations along with conducting research in radio and radar astronomy.

Because of its advanced technical ability to perform the above services, the DSN also is able to carry out the following functions: flight radio-science, very long baseline interferometry (VLBI), and precise measurement of minute earth movements (geodynamics). Until October 1993, when the program was canceled, the DSN also participated in NASA's Search for Extraterrestrial Intelligence (SETI).

The GDSCC also is an R&D center both to extend the communication range and to increase the data acquisition capabilities of the DSN. It serves as a proving ground for new operational techniques. Prototypes of all new equipment are thoroughly tested at the GDSCC before they are duplicated for installation at overseas stations (see Section II.C).

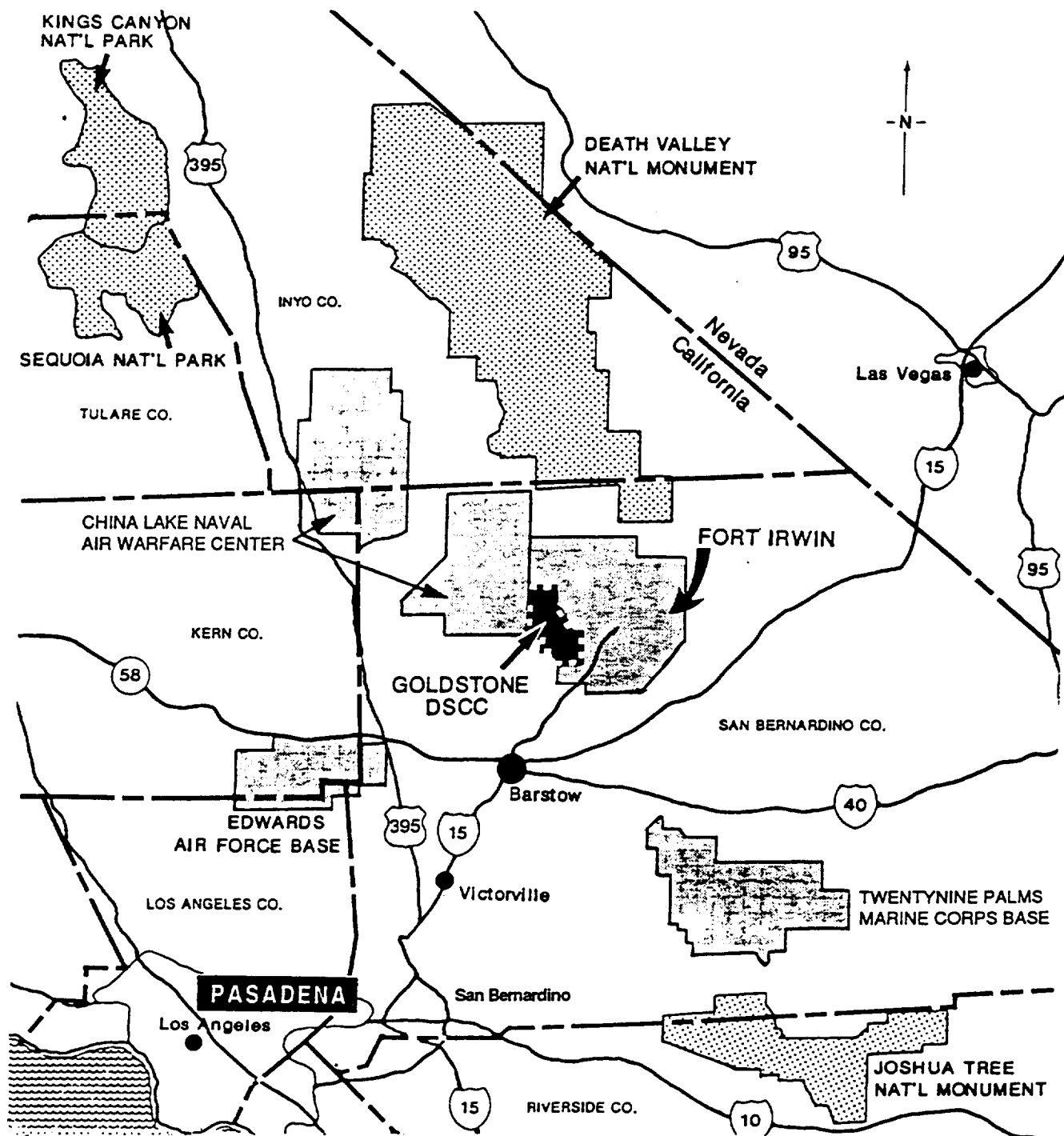


Figure 7. Geographic Relationship of the Goldstone Deep Space Communications Complex (GDSCC) to JPL in Pasadena, California

C. FACILITIES AT THE GDSCC

The GDSCC is a self-sufficient, working community with its own roads, airstrip, cafeteria, electrical power, and telephone systems, and it is equipped to conduct all necessary maintenance, repairs, and domestic support services. Facilities at the GDSCC include approximately 100 buildings and structures that were constructed from the 1950s through the present. The construction of additional buildings and structures continues today as the GDSCC increases its activities and operations.

Goldstone is one of three Deep Space Communications Complexes (DSCCs) operated by NASA. The three DSCCs are located on three continents: at Goldstone in southern California's Mojave Desert; in Spain, about 60 km (37 mi) west of Madrid at Robledo de Chavela; and in Australia, near the Tidbinbilla Nature Reserve, about 40 km (25 mi) southwest of Canberra. Because these three DSCCs are approximately 120 deg apart in longitude, a spacecraft is nearly always in view of one of the DSCCs as the Earth rotates on its axis (Figure 8).

Activities at the GDSCC support nine parabolic dish antennas and their ancillary equipment and installations (that is, nine Deep Space Stations, or DSSs), at five separate sites. Four DSSs (the Mars Station, DSS 14; the Uranus Station, DSS 15; DSS 12 at the Echo Site, and DSS 16 at the Apollo Site) are operational for space missions. Spain and Australia each have four DSSs similar to the four GDSCC DSSs that are operational for space missions. Thus, the NASA DSN has a worldwide network of 12 DSSs operational for space missions (Figure 8).

One Deep Space Station (DSS 13 at the Venus Site) is devoted to R&D activities.

The Mojave Base Site, with one parabolic dish antenna, was operated by the National Oceanic and Atmospheric Administration (NOAA), but its activity was terminated in May 1993.

A Network Operations Control Center (NOCC), located at JPL in Pasadena, controls and monitors the DSN. A Ground Communications Facility (GCF) of the DSN operates to link together the NOCC at JPL with the three DSCCs at Goldstone, Spain, and Australia.

A 26-m (85-ft) antenna, located at the Pioneer Site, was deactivated in 1981. In 1985, the Pioneer antenna (DSS 11) was designated a National Historic Landmark by the U.S. Department of the Interior, and the Pioneer Site was returned to the U.S. Army.

Total NASA/JPL facilities at the GDSCC (Figure 9) include the nine parabolic dish antennas, an airport, a microwave test facility, miscellaneous support buildings, and a remote support facility in Barstow, California, located about 64.5 km (40 mi) south of the GDSCC. The GDSCC support staff consists of about 225 personnel on-site and at the Barstow facility. Table 1 summarizes the major facilities, buildings (number and square footage), and antennas (construction date and size). As noted, the nine parabolic dish antennas are situated at five separate sites, four of which are named Mars, Echo, Apollo and Venus. Two of the nine antennas, DSS 27 and DSS 28, which are located at the fifth site (Gemini), were recently transferred to NASA/JPL from the U.S. Army. The Gemini Site is located before the approach to the Venus Site as one comes into the GDSCC from Barstow.

The five GDSCC sites are briefly described below.

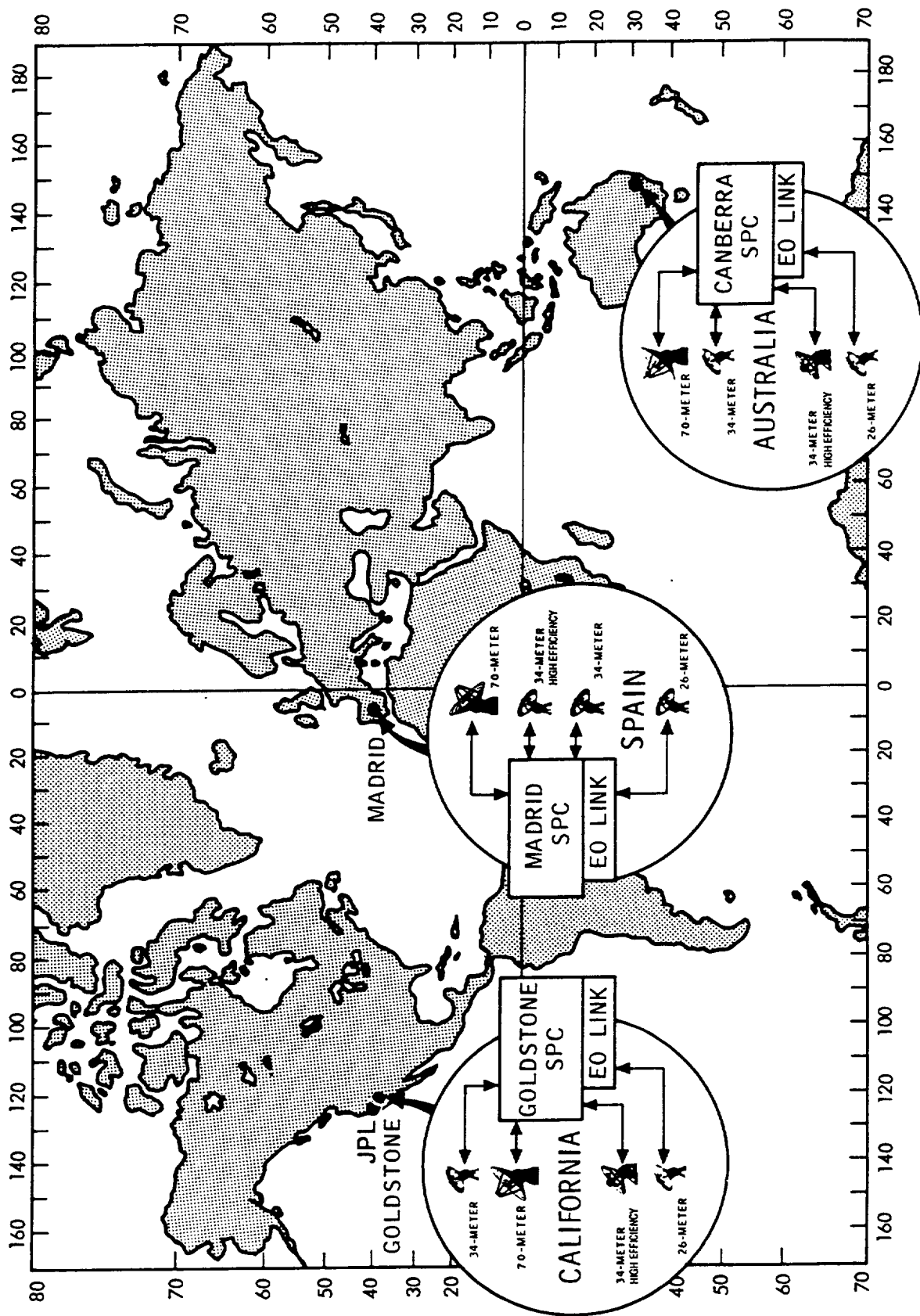


Figure 8. The Three-Continent NASA Deep Space Network as It Exists in 1996

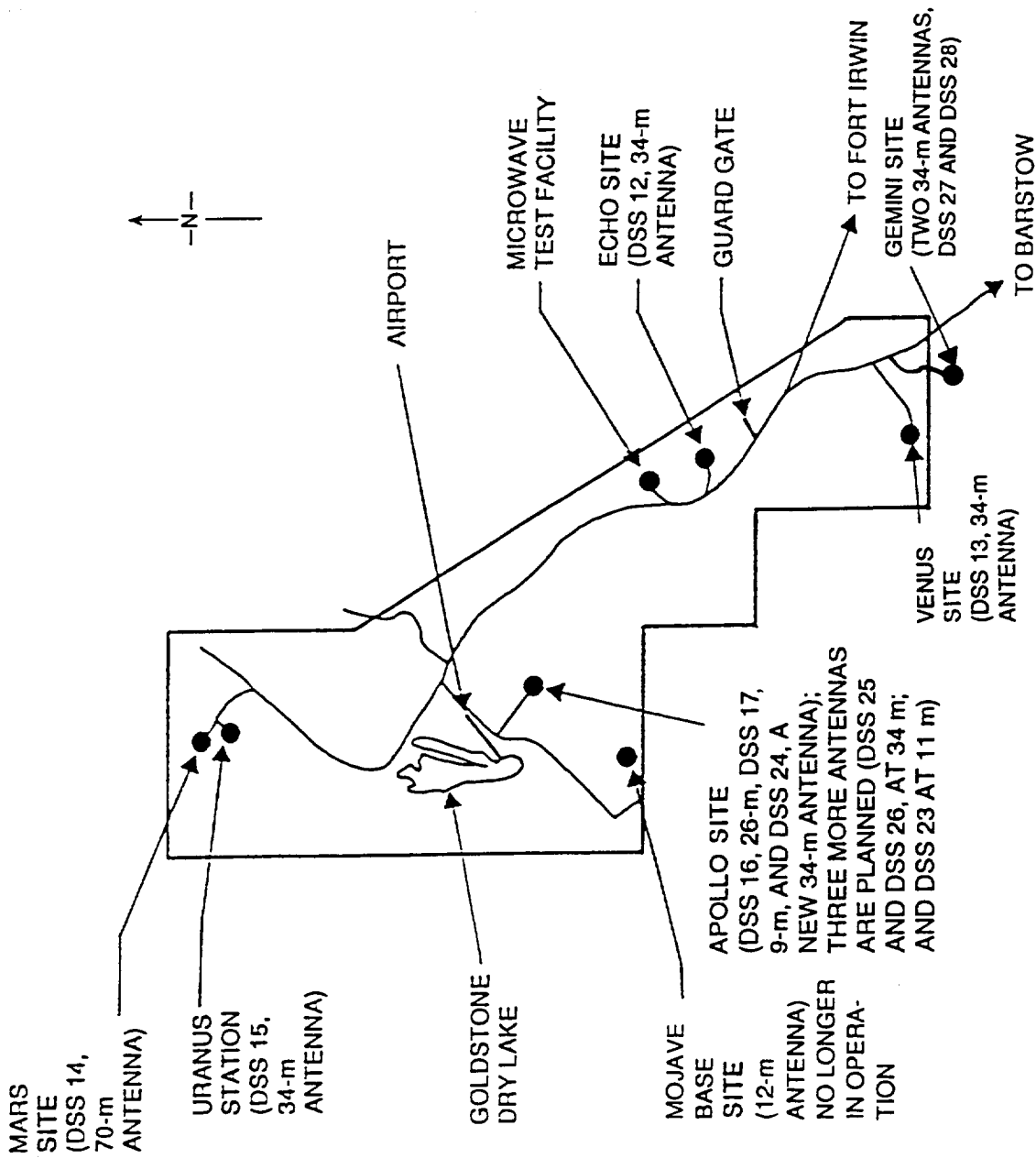


Figure 9. Schematic Map of the GDSCC Showing Locations of the Nine NASA Deep Space Stations (DSSs) and the Mojave Base Site, Once Operated by NOAA

Table 1. Major Facilities at the GDSCC

Site	Station Number	Buildings		Antennas	
		Number	(ft ²) ^a	Date of Construction	Size (meters)
Echo Site	—	25	79,208	—	—
	DSS 12	—	—	1961 ^b	34 ^c
Venus Site	—	15	12,589 ^d	—	—
	DSS 13 (new)	—	—	1991	34
	DSS 13 (old; no longer used)	—	—	1962 ^e	26
	Existing antenna (no number assigned and no longer used)	—	—	—	9
Mars Site	—	14	41,754	—	—
	DSS 14	—	—	1966/1988	70 ^f
	DSS 15	—	—	1984	34
Apollo Site	—	21	43,978	—	—
	DSS 16	—	—	1965 ^g	26
	DSS 17	—	—	—	9
	DSS 24 ^h	—	—	1994	34
Mojave Site	—	5	11,850	1964	12 ⁱ
Airport ^j	—	3	4,848	1963/1970	—
Microwave Test Facility	MTF	1	2,880	1963	—
Miscellaneous	—	3	1,430	—	—
Barstow Facility ^k	—	1	28,343	—	—
Gemini Site ^l	DSS 27	—	—	1994	34
	DSS 28	—	—	1994	34

^a To convert square feet into square meters, multiply by 0.09290.

^b The original antenna, built in 1959, was moved to the Venus Site in 1962. A 26-m antenna, built in 1961, was extended to 34 m in 1978.

^c This antenna is to be dismantled and removed after the DSS-24 antenna at the Apollo Site becomes operational.

^d This square footage does not include two newly constructed facilities for Hazardous Materials Storage and for Acid Wash.

^e This antenna was constructed at the Echo Site in 1959 and moved to the Venus Site in 1962. It no longer is being used and is being offered to any party willing to remove it from the GDSCC.

^f Originally constructed as a 64-m antenna in 1966; enlarged to a 70-m antenna in 1988.

^g This antenna originally was constructed for the NASA Goddard Space Tracking and Data Network. JPL/GDSCC/DSN operation of the antenna began in October 1984.

^h The DSS-24 antenna previously was designated as DSS 18. Three new antennas are now planned for the Apollo Site: DSS 23, 11 m; and DSS 25 and DSS 26, each at 34 m.

ⁱ This antenna was operated by the National Oceanic and Atmospheric Administration (NOAA).

^j The airport is located at the Goldstone Dry Lake.

^k This site, a leased facility, is located in Barstow, California, about 64.5 km (40 mi) southwest of the GDSCC.

^l These two Gemini Site antennas were recently transferred to NASA/JPL from the U.S. Army. The Gemini Site is located before the approach to the Venus Site as one approaches the GDSCC from Barstow.

Source: *Directory of Goldstone DSCC Buildings and Supporting Facilities (Gold) Book*, JPL Document 880-165, internal document, Jet Propulsion Laboratory, Pasadena, California, October 1989 (revised edition).

D. ANTENNA STATIONS AT THE GDSCC

1. Echo Site DSS (DSS 12)

The Echo Site, as the administration center and operations headquarters of the GDSCC, is the most extensively developed site on the complex. It has one 34-m (111.5-ft) antenna and 24 support buildings, with a combined area of 7,358 m² (79,208 ft²). Support buildings include administration and engineering offices, cafeteria, dormitory, transportation and maintenance facilities, storage areas, and warehouses. The original Echo Site antenna was built in 1959 as a 26-m (85-ft) antenna. The antenna was first used in 1960 to support the Echo Project, an experiment to transmit voice communications coast-to-coast by bouncing radio signals off the reflective Mylar surface of a passive balloon-type satellite. In 1962, this original 26-m antenna was moved to the Venus Site. In anticipation of this move, a newer 26-m antenna had been built at the Echo Site in 1961. In 1978, this antenna was enlarged to 34 m (111.5 ft). The present antenna is approximately 35 m (113 ft) high and weighs about 270,000 kg (300 tons). Eventually, its functions are to be replaced by the new beam-waveguide DSS-24 34-m antenna that has been constructed at the Apollo Site.

2. Venus Site (DSS-13)

The Venus Site consists of two antennas: DSS 13, a new 34-m (111.5-ft) antenna, and a 26-m (85-ft) antenna. A 9-m (29.5-ft) antenna previously located at the site has now been removed. The smaller antenna is no longer used. There are 15 buildings with a combined area of 1,170 m² (12,589 ft²). The support buildings provide space for operations control, laboratories, offices, security, workshops, warehouses, and mechanical equipment. The 26-m antenna, which was originally located at the Echo Site, was moved to the Venus Site in 1962. The antenna was used for a radar astronomy study of the planet Venus. Currently, it no longer is in use and is being offered to any party willing to remove it from the GDSCC. The primary functions of the new DSS 13 are R&D and performance and reliability testing of high-power radio-frequency transmitters and new systems and equipment prior to their introduction into the DSN.

The newly constructed DSS-13 antenna, a 34-m (111.5-ft) antenna similar in size to DSS 15 (see below), began operation with R&D activities in 1991. It is to functionally replace the older 26-m antenna. An Environmental Assessment concerning this new DSS-13 antenna is the subject of JPL Publication 87-4, *Environmental Projects: Volume 6, Environmental Assessment: New 34-Meter Antenna at Venus Site*, Jet Propulsion Laboratory, Pasadena, California, June 15, 1988.

3. Mars Site (DSS 14 and DSS 15)

The Mars Site consists of two antennas at two stations (the Mars and Uranus Stations) and 14 buildings, with a combined area of 3,879 m² (41,754 ft²). The support buildings provide facilities for operations control, offices, training, mechanical equipment, storage, and security. The Mars Site now provides the logistics to operate every DSS at the GDSCC. In May 1989, M. B. Gilbert Associates (MBGA), Long Beach, California, submitted an Environmental Assessment to JPL concerning the construction work needed for a building extension to the Operations Building (Bldg. G-86) at the Mars Site. The building extension was completed in 1992.

JPL Publication 87-4, *Environmental Projects: Volume 11, Environmental Assessment: Addition to Operations Building, Mars Site, Jet Propulsion Laboratory, Pasadena, California, February 15, 1990*, is an expanded, JPL version of the Environmental Assessment document submitted to JPL by MBGA in May 1989.

The Mars Station antenna (DSS 14), at 70 m (230 ft) in diameter, is one of the larger antennas of its kind in the world (see front cover). In 1996, the antenna celebrates its 30th anniversary of operation. The antenna, which originally was constructed as a 64-m antenna in 1966 and was enlarged to a 70-m antenna in 1988, is 7.25 times more powerful and sensitive than a 26-m antenna, extending the range of deep space communications by 2.7 times. It can maintain communications with spacecraft to the edge of the solar system. Standing more than 235 ft high, this antenna is one of the more striking features to be seen in the GDSCC geographic area. The 70-m antenna was used in August 1989 for the Voyager 2 spacecraft's encounter with the planet Neptune. The latter is located at a distance of 4.5 billion km (2.8 billion miles) from Earth.

The Uranus Station antenna (DSS 15) has a 34-m (111.5-ft) high-efficiency (HEF), precision-shaped antenna, located approximately 488 m (1,600 ft) southeast of the Mars Station antenna. Built in 1984, this antenna at the GDSCC first was used in January 1986 to support the encounter of the Voyager 2 spacecraft with the planet Uranus. The latter is located at a distance of more than 3 billion km (1.8 billion miles) from Earth. The newly constructed 34-m, precision-shaped antenna at the Venus Site (see above) and the newly constructed DSS-24 antenna at the Apollo Site (see below), are similar in size to this Uranus Station antenna.

4. Apollo Site (DSS 16, DSS 17, and DSS 24)

The Apollo Site has a 26-m (85-ft) antenna (DSS 16), a 9-m (29.5-ft) antenna (DSS 17), and 21 buildings, with a combined total area of 4,086 m² (43,978 ft²). The buildings provide space for operations, equipment, storage, and warehousing. The 26-m antenna originally was constructed in 1965 by NASA's Goddard Space Tracking and Data Network to support the manned Apollo missions to the Moon. Operation of this antenna under JPL management began in October 1984. Both the 26-m and the 9-m antennas now are used to support the missions of the Space Shuttles [Space Transportation System (STS)] and satellites in both low and high Earth orbits. In May 1989, M. B. Gilbert Associates, Long Beach, California, submitted an Environmental Assessment to JPL concerning the construction work needed for a planned new 34-m (111.5-ft) antenna (DSS 24) at the Apollo Site². The details of this Environmental Assessment are described in JPL Publication 87-4, *Environmental Projects: Volume 10, Environmental Assessment: New 34-Meter Antenna at Apollo Site, Jet Propulsion Laboratory, Pasadena, California, January 15, 1990*. Construction of this new DSS 24 antenna now has been completed. Three more antennas are being constructed at the Apollo Site: DSS 23 at 11 m, and DSS 25 and DSS 26, each at 34 m.

5. Gemini Site

The Gemini Site consists of two antennas (DSS 27 and DSS 28), each 34 meters in diameter, that were transferred to NASA/JPL from the U.S. Army in 1994. The Gemini Site is located before the approach to the Venus Site as one approaches the GDSCC from Barstow.

² The newly constructed DSS-24 antenna previously was designated as DSS 18.

6. Mojave Base Site

The Mojave Base Site has one antenna and five buildings, with a combined area of 1,100 m² (11,850 ft²). At one time, these buildings provided support facilities for operations, equipment, and maintenance. These buildings now are not in use.

The Mojave Base Site has a 12-m (40-ft) antenna that until May 1993 had been operated by NOAA. The antenna was involved in several programs, including monitoring of shifts in the Earth's tectonic plates, monitoring weather changes, and retrieving information from very low-orbiting Earth satellites. In May 1993, all NOAA activities ceased at the Mojave Base Site.

E. SUPPORT FACILITIES AT THE GDSCC

1. Goldstone Dry Lake Airport

The airport consists of an approximately 1,829-m x 31-m (6,000-ft x 100-ft) paved runway. There are two buildings at the airport site neither of which is presently in use. An open hangar is used to provide shelter for a single aircraft. For its personnel, NASA operates three scheduled shuttle flights per week to the GDSCC that originate from the Van Nuys Airport. In addition, the Goldstone airport is used infrequently by administrative U.S. Army flights. Both NASA and the U.S. Army use propeller-driven aircraft.

2. Microwave Test Facility and Fire-Training Area

The Microwave Test Facility (MTF) and Fire-Training Area consist of a single building of 268 m² (2,880 ft²) along with areas identified for fire fighting. The MTF is used for R&D testing of antenna microwave equipment. Fire training includes procedures for the quenching of fires.

3. Miscellaneous Buildings in the GDSCC Area

Three buildings and structures at the GDSCC that fall into this category include the main gate house, pump house, and radio spectrum monitor. The total area of these three buildings/structures is 133 m² (1,430 ft²).

4. Off-Site Facility at Barstow, California

In addition to the above-mentioned on-site facilities, the GDSCC leases an office and warehouse support facility. The facility is a single-story, 2,633-m² (28,343-ft²) structure located at 850 Main Street, in the nearby city of Barstow. The Barstow facility is responsible for the calibration and repair of station test equipment, for personnel administration, for support of antenna hydraulic systems, and for general logistic support.

F. NONSTRUCTURAL SUPPORT FACILITIES AT THE GDSCC

1. Transportation Network

The major roadways in the area are shown in Figure 10. The only surface public transportation route to the GDSCC is by the Fort Irwin Road that leads to Fort Irwin. The NASA Road cutoff from Fort Irwin Road leads into the GDSCC. The NASA Road merges with Goldstone Road, which is the only north-south paved access road within the complex. Both the NASA and Goldstone Roads are

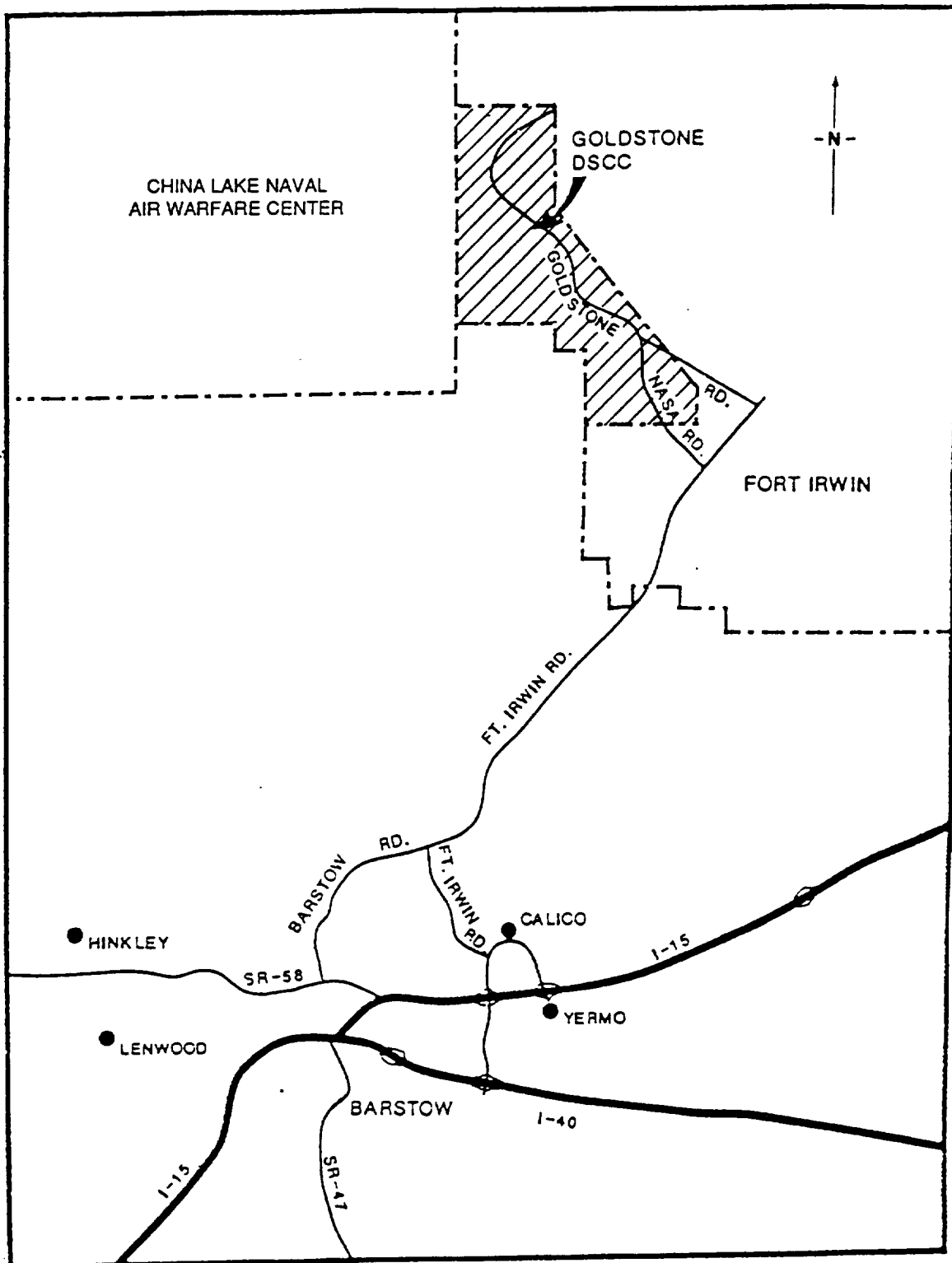


Figure 10. Major Roads Leading to and at the GDSCC

paved two-lane roads and are maintained by the Fort Irwin Post Engineer. Two-lane paved access roads also lead to each of the sites and major facilities.

2. Utilities and Services

The Southern California Edison Company provides electricity for the Goldstone Complex. The GDSCC provides its own backup diesel-engine generators to ensure operations during emergencies and continuity of electrical service for prescheduled periods of time. Gasoline, diesel oil, and hydraulic oil are stored in double-walled underground storage tanks (USTs) fitted with sensors between the walls to detect leaks. Water is supplied by Fort Irwin from groundwater basin wells. Sanitary sewage is discharged through septic tank systems to leaching fields. The Echo and Mars Sites discharge wastewater to evaporation ponds (see JPL Publication 87-4, *Environmental Projects: Volume 8, Modifications of Wastewater Evaporation Ponds*, Jet Propulsion Laboratory, Pasadena, California, October 15, 1989).

G. SOLID-WASTE MANAGEMENT FACILITIES AT THE GDSCC

At the Echo Site, the GDSCC operates its own 4.05-hectare (10-acre), Class III landfill. This facility accepts only nonhazardous, solid wastes.

Most of a small quantity of hazardous waste, generated at the GDSCC each year, is sent to off-site commercial facilities for reclamation and eventual reuse. The remainder is transported to off-site commercial treatment or disposal facilities within 90 days of generation. The GDSCC now has two, new, centralized storage facilities for hazardous materials and wastes: one is located at the Echo Site, the other at the Venus Site. In addition, nine decentralized storage facilities for hazardous materials are located as follows: three facilities at the Echo Site, four at the Mars Site, and one each at the Apollo and Venus Sites. The GDSCC does not operate any facilities that require a hazardous waste permit. Details concerning the construction of the two new centralized storage facilities for hazardous materials and wastes at the Echo and Venus Sites are described in JPL Publication 87-4, *Environmental Projects: Volume 9, Construction of Hazardous Materials Storage Facilities*, Jet Propulsion Laboratory, Pasadena, California, November 15, 1989. The nine decentralized storage facilities for hazardous materials and wastes were completed in 1990. In accordance with its environmental management program, the GDSCC conducts all of its waste-management operations in strict compliance with environmental regulations, in a manner consistent with protection of human health and the environment.

H. WASTEWATER MANAGEMENT FACILITIES AT THE GDSCC

Four functioning sewage evaporation ponds, one pair at the Echo Site and another pair at the Mars Site, are designed to receive effluent from an upstream septic tank system. Extensive work was completed in the spring of 1989 to repair and reshape the previously eroded embankments of the wastewater evaporation ponds. Details of this construction work are recorded in JPL Publication 87-4, *Environmental Projects: Volume 8, Modifications of Wastewater Evaporation Ponds*, Jet Propulsion Laboratory, Pasadena, California, October 15, 1989. Since this report was written, another pair of sewage evaporation ponds has been constructed at the Mars Site. All sewage evaporation ponds now are lined with concrete banks.

I. UNDERGROUND STORAGE TANKS (USTs) AT THE GDSCC

As a large-scale facility located in a remote, isolated desert region, the GDSCC operations to support the various DSS antennas require numerous on-site storage facilities for gasoline, diesel oil, hydraulic oil, and waste oil. The most environmentally safe and economical way to store large quantities of these liquids is in double-walled, steel shells with outer fiberglass coating for corrosion protection, and a monitoring system in the annular space between the inner and outer shells to detect any leaks from either shell.

The installation of 13 new USTs with the above-described, environmentally safe properties (7 at the Echo Site, 5 at the Mars Site, and 1 at the Mojave Base Site) is discussed in detail in JPL Publication 87-4, *Environmental Projects: Volume 13, Underground Storage Tanks: Removal and Replacement*, Jet Propulsion Laboratory, Pasadena, California, February 15, 1991.

The removal of soil that had been contaminated by leakage from some of the old USTs is discussed in detail in JPL Publication 87-4, *Environmental Projects: Volume 14, Removal of Contaminated Soil and Debris*, Jet Propulsion Laboratory, Pasadena, California, March 1992.

J. OPERATIONAL RELATIONSHIPS BETWEEN THE GDSCC AND FORT IRWIN

Because the GDSCC is located within the Fort Irwin property, the two installations potentially can affect each other's roles and missions. Fort Irwin is a U.S. Army installation serving as the U.S. Army National Training Center (NTC). The remote desert environment allows military task forces to practice large-scale training maneuvers that could affect natural, historic, and cultural resources at the GDSCC. This especially is true when the maneuvers involve the movement of heavy equipment (tanks, large trucks) within the GDSCC. Most maneuvers occur at the eastern border of the GDSCC, and every effort is made by both the GDSCC and Fort Irwin personnel to avoid the use of sensitive areas for such maneuvers.

K. NATURAL ENVIRONMENTAL ASPECTS OF THE GDSCC

1. Geology

The GDSCC is located in the North Central section of the Mojave Desert Province. Typically, the Mojave Desert Province consists of broad, flat plains separated by low mountains [305 to 610 m (1,000 to 2,000 ft) of topographic relief]. The GDSCC is situated within one of these low mountain areas.

The GDSCC is located in a naturally occurring bowl-shaped depression area bounded on three sides by geological faults. The Garlock Fault lies to the north, while the Blackwater and Calico Faults lie, respectively, to the west and south. The GDSCC is bounded on the east by the Tiefort Mountains. Each antenna site at the GDSCC is located on natural alluvial material, ranging in thickness from 4.6 m (15 ft) at the Venus Site to more than 21.3 m (70 ft) at the Echo Site. The alluvium is derived from the surrounding hills.

2. Hydrology

Groundwater in the Goldstone area is generally confined and is found at depths ranging from 51.8 m (170 ft) near the Minitrack Site to approximately

305 m (1,000 ft) below the Echo Site. Chemical analyses of the groundwater have yielded total dissolved solids (TDS) values in excess of 1,000 ppm, indicating that the groundwater is brackish. The Goldstone Complex currently obtains potable water from a group of wells located at Fort Irwin, approximately 16.09 km (10 mi) to the southeast.

3. Climatic Conditions

The GDSCC lies within the U.S. Naval Weather Service's Southwest Desert, Climatic Area A. Mean annual temperatures for the area range from 10 to 26.7°C (50 to 80°F). Temperatures can climb as high as 45.5°C (114°F) during the summer months, and drop as low as -11.7°C (11°F) during the winter months. Mean annual precipitation for the area is approximately 6.35 cm (2.5 in.); most precipitation falls between November and February.

SECTION III

BIOLOGICAL ASSESSMENT SURVEY OF THE GEOGRAPHY, TERRAIN, CLIMATE, VEGETATION AND WILDLIFE AT THE DSS 24 ANTENNA AT THE APOLLO SITE

A detailed description of the environmental, biological, geological, meteorological, and human aspects of the GDSCC is presented in Appendix A.

A. GEOGRAPHY OF THE DSS 24 ANTENNA AREA

The site of the DSS 24 antenna is designated as Sections 3 and 4, Township 15N, Range 1E, San Bernardino County, California. As such, this Apollo Site is part of the GDSCC, approximately 64.5 km (40 miles) northeast of Barstow, California.

The area under Biological Assessment is roughly trapezoidal in shape with approximate dimensions of 261 m (855 ft) on the western and eastern sides, 128 m (420 ft) on the southern side, and 185 m (600 ft) on the northern side (Figure 4).

B. TERRAIN OF THE DSS 24 ANTENNA AREA

The GDSCC is located in the north-central section of the Mojave Desert Province, a wedge-shaped, down-faulted block that is bounded by mountain ranges to the north-northwest and south-southwest.

Typically, the Mojave Desert Province is characterized by broad, flat valley plains and by gently sloping alluvial fans that extend outward from the mountains (bajadas).

Elevations in the Goldstone area range from 822 m (2,895 ft) to 1,369 m (4,491 ft) above mean sea level (MSL). The GDSCC lies within a 181.3 square kilometer (70 square mile) internal drainage area that includes Goldstone Dry Lake, the largest of several dry lakes within the area. The elevation of Goldstone Dry Lake is 921 m (3,021 ft) above MSL.

C. CLIMATE OF THE DSS 24 ANTENNA AREA

Climate at the GDSCC is arid with characteristically wide ranges in daily and seasonal temperatures, as well as a high variability of precipitation. Average annual rainfall is approximately 14 cm (5.5 in). Recorded annual precipitation ranges from a low of 1.27 cm (0.5 in) to a high of 38 cm (15 in). Precipitation is typified by short-lived, high-intensity storms that may produce local flash floods. More than one-half of the average annual precipitation has been known to fall in a three-day period, during which peak rainfall may be as high as 5 cm (2 in) in one hour.

D. VEGETATION OF THE DSS 24 ANTENNA AREA

Botanically, the Mojave Desert represents a transition between two much larger arid regions, the Great Basin to the north and the Sonoran Desert to the southeast.

The vegetation at the DSS 24 antenna site is typical of a diverse, mid-elevation, Mojave Desert creosote bush community. It is dominated by creosote bush (*Larrea tridentata*) and burro-weed (*Ambrosia dumosa*). Some Joshua trees (*Yucca brevifolia*) are scattered across the alluvial fan and on some of the adjacent steep slopes.

Interspersed among the shrubs are perennial bunchgrasses including big galleta (*Hilaria rigida*) and Indian ricegrass (*Oryzopsis hymenoides*), and sparse stands of annual forbs (vegetation other than grasses that is useful for fodder). At the time of the BPNL Biological Assessment, January 7, 1992, only the remnants of shoots of annual plants were present.

The technique used to determine the shrub and perennial grass components of the vegetation involved the placement of 12 transect lines, each 50 m (164 ft) long, at stratified random locations within the boundaries of the construction site. The lines were oriented at right angles to the slope gradient along an east-west direction. Groups of three transect lines were placed at four different elevation levels within the site boundaries. Canopy cover of the shrubs and the perennial bunchgrasses was measured using a line-intercept method, where each shrub or grass cluster that intersected the transect line was measured to determine the distance along the line where the canopy intersected the line. In addition, the height of each shrub from ground level was measured. All measurements were made to the nearest 5 cm (1.96 in.).

All shrubs were identified with regard to species, and the percentage of the canopy cover for each species was calculated.

Table 2 shows that only 17 percent of the ground area at the construction site was covered by shrubs and perennial grasses. This is to be expected as a sparse, low-percentage canopy cover is characteristic of plant communities in the Mojave Desert. Of the 130 individual shrubs observed along the transect lines, most of the canopy cover (11 percent) was provided by creosote bush and burro-weed (Table 3).

Even though the mean canopy cover for creosote bush (7 percent) is higher than that for burro-weed (4 percent), a greater number of burro-weed shrubs were found than creosote bushes. The reason that the mean canopy cover for creosote bushes is greater than for burro-weed shrubs, even though the number of burro-weed shrubs is greater than the number of creosote bushes, is because a creosote bush is a much larger shrub than is the burro-weed shrub.

The three transects at the northern end of the construction site, adjacent to the main Apollo Site, revealed a greater disturbance of the vegetation as compared to other transects. Some crushed creosote shrubs and other dead shrub species were observed.

Table 4 shows the distribution of the observed vegetation ranked according to height. Although the height of creosote bushes ranged from 0.2 to 2.4 m (7.8 to 94.5 in.), about 60 percent of the plants were small, ranging from 0.2 to 0.4 m (7.8 to 16 in.).

Other common annual plants were identified through an examination of the standing dead plant material on the site. Table 5 lists the various plant species observed on the site.

Table 2. Mean Canopy Cover Provided by Shrubs and Perennial Grasses
at the DSS 24 Construction Site on January 7, 1992

Species	Mean Canopy Cover (%)
Shrubs	
Creosote bush (<i>Larrea tridentata</i>)	7.07
Burro-weed (<i>Ambrosia dumosa</i>)	4.04
Hop-sage (<i>Grayia spinosa</i>)	1.92
Goldenbush (<i>Haplopappus</i> sp.)	0.43
Turpentine-broom (<i>Thamnosoma montana</i>)	1.00
Burrobrush (<i>Hymenoclea salsola</i>)	0.76
Bladder sage (<i>Salazaria mexicana</i>)	0.25
<i>Krameria parvifolia</i>	0.13
Mormon tea (<i>Ephedra</i> spp.)	0.22
Joshua tree (<i>Yucca brevifolia</i>)	0.07
Desert aster (<i>Machaeranthera</i> sp.)	0.08
Grasses	
Indian ricegrass (<i>Oryzopsis hymenoides</i>)	0.07
Big galleta (<i>Hilaria rigida</i>)	<u>1.22</u>
Total Cover	17.25

Table 3. Number of Individual Shrubs Observed Along the Transect Lines

Species	Number of Plants
Burro-weed (<i>Ambrosia dumosa</i>)	51
Creosote bush (<i>Larrea tridentata</i>)	30
Hop-sage (<i>Grayia spinosa</i>)	18
Turpentine-broom (<i>Thamnosoma montana</i>)	11
Burrobrush (<i>Hymenoclea salsola</i>)	9
Goldenbush (<i>Haplopappus</i> sp.)	7
Bladder sage (<i>Salazaria mexicana</i>)	2
Mormon tea (<i>Ephedra</i> spp.)	<u>2</u>
Total Shrubs	130

Table 4. Percent of Shrubs Observed Along the Transect Lines
Arranged According to Height Classes

Height Class (Decimeters)	LATR ^a	AMDU ^b	GRSP ^c	HYSA ^d	THMO ^e	HA ^{sp} ^f
≤2	—	11.8	22.2	22.2	18.2	5.7
>2-4	6.7	72.5	66.7	55.6	63.6	14.3
>4-6	—	5.7	11.1	11.1	18.2	—
>6-8	—	—	—	11.1	—	—
>8-10	6.7	—	—	—	—	—
>10-12	33.3	—	—	—	—	—
>12-14	26.7	—	—	—	—	—
>14-16	—	—	—	—	—	—
>16-18	13.3	—	—	—	—	—
>18-20	6.7	—	—	—	—	—
>20-22	—	—	—	—	—	—
>22-24	6.7	—	—	—	—	—

^a LATR = *Larrea tridentata*.

^b AMDU = *Ambrosia dumosa*.

^c GRSP = *Grayia spinosa*.

^d HYSA = *Hymenoclea salsola*.

^e THMO = *Thamnosoma montana*.

^f HA^{sp} = *Haplopappus*.

Table 5. Species Found on or Near the DSS 24 Construction Site
on January 7, 1992

Shrubs

Creosote bush (*Larrea tridentata*)
 Burro-weed (*Ambrosia dumosa*)
 Hop-sage (*Grayia spinosa*)
 Goldenbush (*Haplopappus* sp.)
 Burrobrush (*Hymenoclea salsola*)
 Turpentine-broom (*Thamnosoma montana*)
 Mormon tea (*Ephedra* sp.)
 Little-leaved ratany (*Krameria parvifolia*)
 Bladder sage (*Salazaria mexicana*)
 Budsage (*Artemisia spinescens*)
 Box thorn (*Lycium andersonii*)
 Saltbush (*Atriplex confertifolia*)
 Fourwing saltbush (*Atriplex canescens*)
 Joshua tree (*Yucca brevifolia*)

Perennial Grasses

Big galleta (*Hilaria rigida*)
 Indian ricegrass (*Oryzopsis hymenoides*)
 Desert needlegrass (*Stipa speciosa*)

Annuals^a

Red-stemmed filaree (*Erodium cicutarium*)
 Desert trumpet (*Eriogonum inflatum*)
 Foxtail chess (*Bromus rubens*)
 Mediterranean grass (*Schismus barbatus*)
 Brittle spineflower (*Chorizanthe brevicornu*)
 Pincushion (*Chaenactis* sp.)
Streptanthella
 White-stemmed stickleaf (*Mentzelia albicaulis*)
Linanthus sp.
 Sun cup (*Camissonia* sp.)
 Tansy mustard (*Descurainia* sp.)
Oxytheca perfoliata
Malacothrix sp.
 Prince's plume (*Stanleya* sp.)
 Wild buckwheat (*Eriogonum* spp.)

Cacti

Prickly-pear (*Opuntia* sp.)
 Clustered barrel cactus (*Echinocactus* sp.)

^a Annuals were identified from standing dead material.

Most importantly for the BPNL Biological Assessment, no Lane Mountain milk vetch plants were found. This milk vetch is the only threatened or candidate threatened plant species that the U.S. Fish and Wildlife Service indicated may be found in the region in which the construction site is located.

E. WILDLIFE OF THE DSS 24 ANTENNA AREA

Wildlife surveys of the DSS 24 construction area, including live trapping of small mammals, desert tortoise transects, and bird observation, were conducted in a three-day period from January 6 to 9, 1992. Detailed lists of amphibians and reptiles, birds and mammals that may be found at or in the vicinity of the DSS 24 construction site may be found in Section V of JPL Publication 87-4, *Environmental Projects: Volume 10, Environmental Assessment: New 34-Meter Antenna at Apollo Site*, Jet Propulsion Laboratory, Pasadena, California, January 15, 1990.

1. Mammals

During three nights, January 6 through January 9, 1992, traps were set on the DSS 24 construction site. One hundred Sherman live traps were placed in a grid pattern. There were four lines of traps, of 25 traps each, with the lines placed 10 m (32.8 ft) apart. In each line, traps were put down at intervals of 5 m (16.4 ft). This configuration of traps was selected because it provided thorough coverage of the antenna's construction site.

Four species of small mammals were trapped with Merriam's kangaroo rat (*Dipodomys merriami*) being the most frequently captured rodent with 27 captures. Of these 27 captured kangaroo rats, 16 were females and 11 were males. Of four kangaroo rats that were captured the first evening, one was recaptured the second evening, and three were recaptured the third evening.

Of two antelope ground squirrels (*Ammospermophilus leucurus*) captured, a female was trapped the first evening and a male the second evening. The male had scrotal testes indicating he was reproductively active.

In addition, one male desert woodrat (*Neotoma lepida*) was captured the second evening, and one female deer mouse (*Peromyscus maniculatus*) was trapped the first evening.

Table 6 lists each day's capture by sex and weight.

One coyote (*Canis latrans*) and numerous scats and tracks were observed. Reportedly, the coyote is abundant and widespread throughout Fort Irwin and the GDSCC. Several burrows of the kit fox (*Vulpes macrotis*) also were observed while the field crew looked for desert tortoises. The kit fox is reported to be numerous and widespread on Fort Irwin.

Although the U.S. FWS indicated that the Mojave ground squirrel is a candidate threatened species, and its range lies within the DSS 24 construction site, this species is inactive in January and the trapping effort was not designed to inventory this species.

The Mojave ground squirrel has a very restricted range, being limited to the western part of the Mojave Desert. This range does include the GDSCC and Fort Irwin, in general, and the DSS 24 construction site, in particular.

Table 6. Small Mammal Captures at the DSS 24 Antenna Construction Site,
January 7-9, 1992^{a,b,c,d}

Species	Sex	Weight (g)	Date Captured
<i>D. merriami</i>	M	41.0	7 January 1992
<i>D. merriami</i>	F	38.0	7 January 1992
<i>D. merriami</i>	F	38.0	7 January 1992
<i>D. merriami</i>	M	46.0	7 January 1992
<i>D. merriami</i>	F	40.0	7 January 1992
<i>D. merriami</i>	M	41.0	7 January 1992
<i>D. merriami</i>	M	43.0	7 January 1992
<i>D. merriami</i>	F	37.0	7 January 1992
<i>D. merriami</i>	M	41.0	7 January 1992
<i>D. merriami</i>	F	40.0	7 January 1992
<i>D. merriami</i>	F	39.0	7 January 1992
<i>D. merriami</i>	M	45.5	7 January 1992
<i>D. merriami</i>	F	37.0	7 January 1992
<i>P. maniculatus</i>	F	12.0	7 January 1992
<i>A. leucurus</i>	F		7 January 1992
<i>N. lepida</i>	M		8 January 1992
<i>D. merriami</i>	M	42.0	8 January 1992
<i>D. merriami</i>	M	41.0	8 January 1992
<i>D. merriami</i>	M	48.0	8 January 1992
<i>D. merriami</i>	F	36.0	8 January 1992
<i>D. merriami</i>	F	41.0	8 January 1992
<i>D. merriami</i>	M	40.0	8 January 1992
<i>D. merriami</i>	M	Recapture	8 January 1992
<i>D. merriami</i>	F	40.0	8 January 1992
<i>A. leucurus</i>	M		8 January 1992
<i>D. merriami</i>	F	42.0	9 January 1992
<i>D. merriami</i>	F	38.0	9 January 1992
<i>D. merriami</i>	M	Recapture	9 January 1992
<i>D. merriami</i>	F	35.0	9 January 1992
<i>D. merriami</i>	M	Recapture	9 January 1992
<i>D. merriami</i>	F	Recapture	9 January 1992
<i>D. merriami</i>	F	40.0	9 January 1992
<i>D. merriami</i>	M	49.0	9 January 1992
<i>D. merriami</i>	F	34.0	9 January 1992
<i>D. merriami</i>	F	50.0	9 January 1992

^a 100 traps used per night = 300 trap nights = 200 trap days.

^b Temp (°F) = low 28°, high 50° during trapping session.

^c Cloud cover = 100% on 7, 8 January and 0% on 9 January.

^d Precipitation = 0.

At present, the California Department of Fish and Game (CDFG) lists the Mojave ground squirrel as a threatened species, while the U.S. FWS categorizes the species as "Candidate level 2" for a threatened species.

The Mojave ground squirrel's habitats include alkali sink, saltbush scrub, creosote bush scrub, Joshua tree woodland, and blackbush scrub communities. Previous surveys, carried out before the BPNL Biological Assessment, show that the Mojave ground squirrel has been observed and trapped at several locations on Fort Irwin and Goldstone. Table 7 shows that several observations and trappings have occurred near Goldstone Dry Lake and Echo Site.

Although no Mojave ground squirrels were expected to be trapped in the month of January, when the BPNL Biological Assessment survey was carried out, the data in Table 7 show that the Mojave ground squirrel does occur in the vicinity of the Apollo Site and the DSS 24 antenna construction site. It must be assumed, therefore, that some Mojave ground squirrels could occur at the construction site and that some of their habitat possibly could be lost in the siting of the antenna.

Because of this possibility, a Cumulative Habitat Impact Analysis (CHIA) of the construction site was conducted to determine whether the construction site was suitable as a habitat for the Mojave ground squirrel.

The CHIA was conducted on January 8, 1992 and is documented as Appendix B. A careful walk over the construction site as well as detailed analyses of the vegetation as depicted in Tables 2 through 5 gave a CHIA score of 20. This CHIA evaluation indicates that the antenna construction site could be a suitable habitat for the Mojave ground squirrel.

2. Birds

During the three days that the BPNL Biological Assessment survey was conducted, January 6 through January 9, 1992, seven species of birds were observed with starlings (*Sturnus vulgaris*) and house sparrows (*Passer domesticus*) being the most abundant. Also conspicuous were rock wrens (*Salpinctes obsoletus*) that often were heard calling and seen foraging on the ground.

Also seen several times at the construction site were white-crowned sparrows (*Zonotrichia leucophrys*) and horned larks (*Eremophila alpestris*). Ravens (*Corvus corax*) were observed flying about and perching on the Apollo Site antenna DSS 16.

Obviously, the small number of bird species observed clearly was because the survey was carried out in January. Had the survey been conducted in the springtime, other species, particularly black-throated sparrows (*Amphispiza bilineata*), would have been observed as they returned to the area from wintering regions to the south. A previous survey, conducted in April/May 1991 observed 21 species of birds at Fort Irwin.

Some other bird species that are expected to breed in the creosote bush scrub community within the vicinity of the construction site are Say's phoebe (*Sayornis saya*), Le Conte's thrasher (*Toxostoma lecontei*), mourning dove (*Zenaida macroura*), and the loggerhead shrike (*Lanius ludovicianus*).

Table 7. Various Locations at the GDSCC Where Mojave Ground
Squirrels Have Been Trapped or Observed, 1983-1987

Goldstone Location	UTM ^a Coordinates	Number Captured or Observed
1.5 km (0.93 miles) SE of Echo	190060 196055 190046 178055	7
2.5 km (1.55 mi) NNW of Echo	170085	1
2 km (1.24 mi) NNW at North end of Goldstone Dry Lake	083158	2
Road on East side of Goldstone Dry Lake	116145	1 roadkill observed
^a UTM = Universal Transit Marker		

In addition, four species of raptors (birds of prey) may breed in the vicinity of the antenna site, and may use the scrub plant communities for forage. Common barn owls (*Tyto alba*), red-tailed hawks (*Buteo jamaicensis*), prairie falcons (*Falco mexicanus*) and even golden eagles (*Aquila chrysaetos*) could inhabit the area.

3. Reptiles

Because of the timing of the BPNL Biological Assessment in the month of January, when ambient temperatures are low, no reptile species were observed.

The reptile species usually associated with a creosote bush scrub community such as that at the DSS 24 antenna site are the common lizards, western whiptail (*Cnemidophorus tigris*), zebra-tailed lizard (*Callisaurus draconoides*), and the side-blotched lizard (*Uta stansburiana*).

In addition, other reptile species that could be observed with some frequency are the desert iguana (*Dipsosaurus dorsalis*), common leopard lizard (*Gambelia wislizenii*), coachwhip (*Masticophis flagellum*), gopher snake (*Pituophis melanoleucus*), sidewinder (*Crotalus cerastes*) and the Mojave green rattlesnake (*Crotalus scutulatus*).

The reptile species most pertinent to the DSS 24 antenna site is the desert tortoise (*Gopherus agassizii*). This tortoise is listed as a threatened species by the U.S. FWS.

A broken carapace (shell) of an adult desert tortoise was found about 500 m (1,640 ft) to the west of the construction site (Figure 11). The discovered carapace was smashed, perhaps by being run over by a vehicle. Although all soft parts of the tortoise were gone, the shell was unbleached, indicating that the tortoise was killed sometime in the previous year. The shell was lying in a draw about 15 m (50 ft) from a dirt road that leads into the main Apollo Site.

In addition to finding the desert tortoise shell, two tortoise burrows also were found while transect counts for the tortoises were conducted. One burrow was situated more than 800 m (2,625 ft) southeast of the construction site, while the other was located about 400 m (1,312 ft) to the northeast.

As indicated in Section I.B, the construction site is about 3.24 hectares (8 acres) in size and within this area the DSS 24 antenna and support pad encompass a diameter of 128 m (420 ft).

To search for potential evidence of the desert tortoise, the entire 3.24 hectare area of the construction site was divided into 33 transect lines, 21 in the southern part of the Apollo Site and 12 in the northwest corner. The 33 transect lines were separated from one another by an interval of 10 m (32.8 ft) (Figure 12). Additional transect bands at 100, 200, 400 and 800 m (328, 656, 1,312 and 2,625 ft) also were walked around the perimeter of the construction site (Figure 13). The entire Apollo Site area was included in the desert tortoise survey because a blacktopped road 86.35 m (280 ft) long runs from the main Apollo Site to the construction site of the DSS 24 antenna.

Previous desert tortoise surveys indicated that the construction area could have a possible density of about 20 tortoises/2.59 km² (20 tortoises per mi²). Data sheets recording the desert-tortoise-density transects are presented in Appendix C.

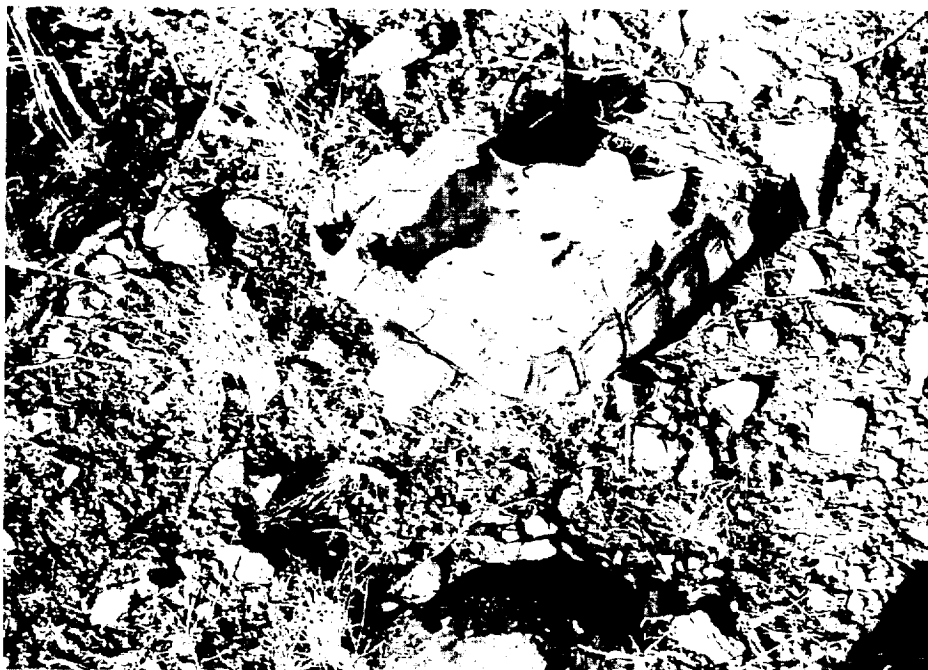


Figure 11. Crushed Shell of a Desert Tortoise Found 500 m From the DSS-24 Antenna Site

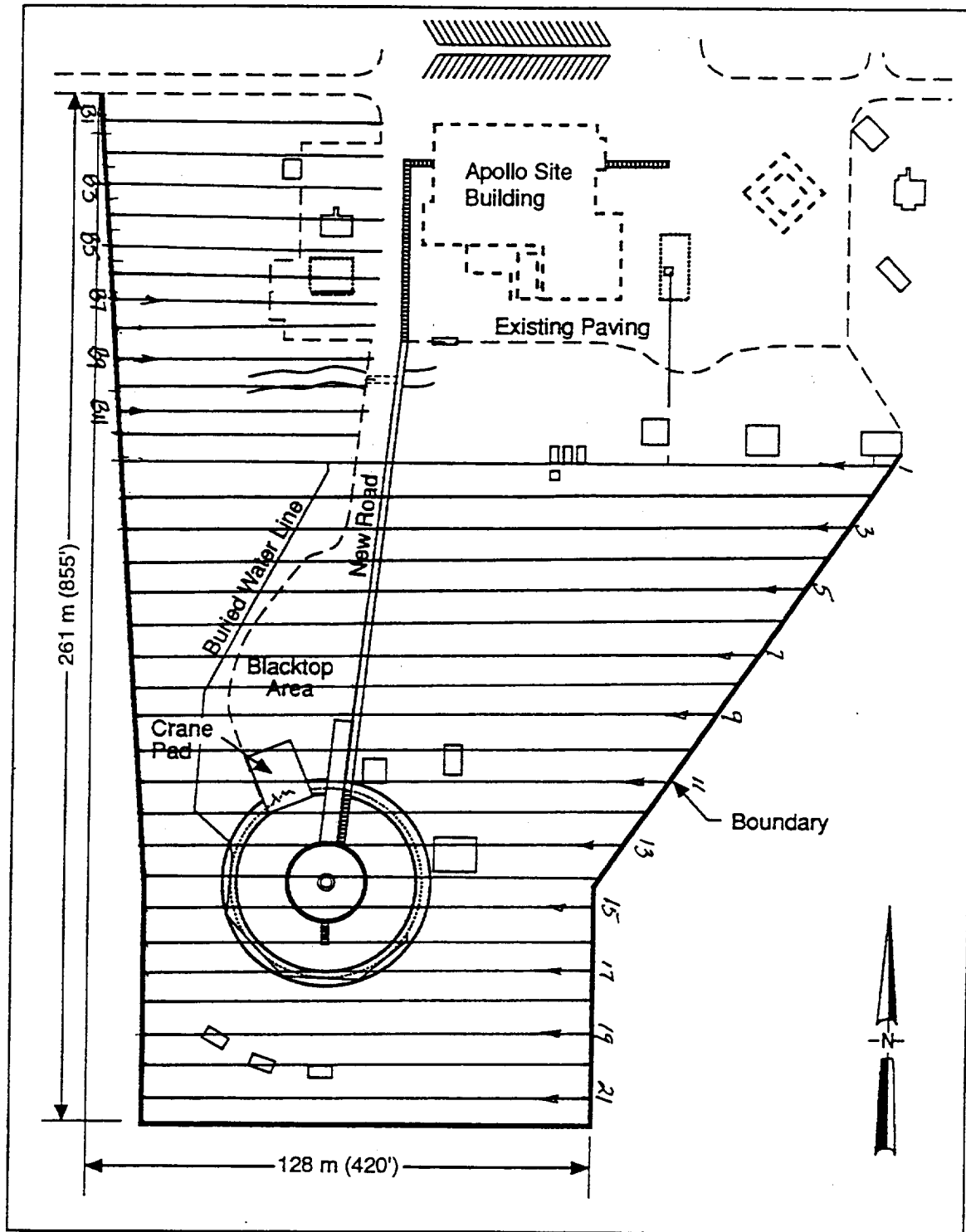


Figure 12. Transect Marker Lines for the Desert Tortoise at the DSS 24 Antenna Site Run West to East, With 21 Lines in the Large Southern Area and 12 Shorter Lines in the Northwest Corner

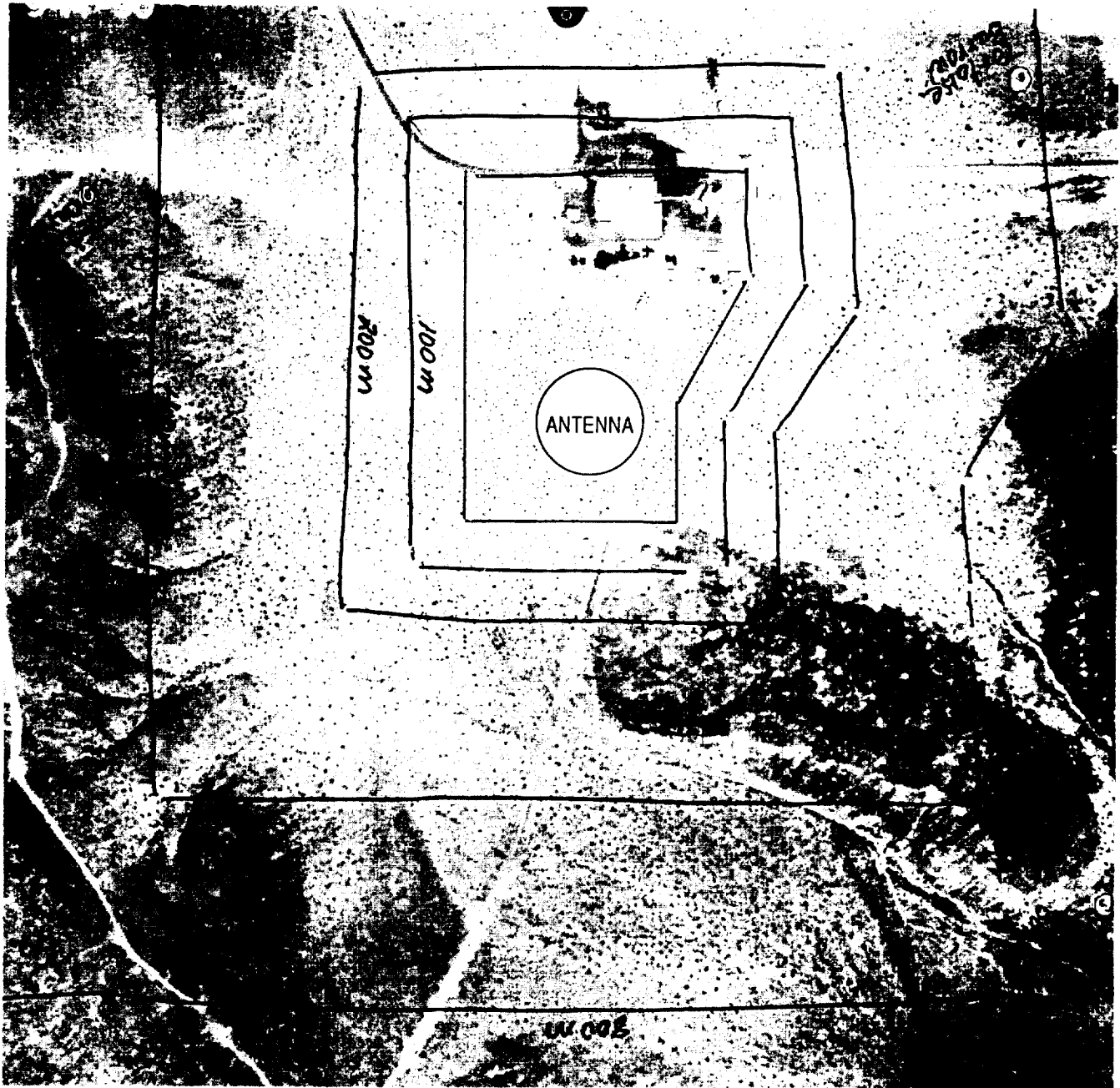


Figure 13. Aerial Photograph of Apollo Site at the GDSCC: Superimposed are the 100 m, 200 m, 400 m, and 800 m Desert Tortoise Transect Lines and the Locations of the Tortoise Burrows and Carcass

SECTION IV

CONSEQUENCES OF THE BIOLOGICAL ASSESSMENT

A. PROCEDURES TO PROTECT WILDLIFE AT THE DSS 24 CONSTRUCTION SITE

Correspondence between JPL and various governmental agencies concerning the biological and environmental assessments involved with the construction of the new DSS 24 antenna at the Apollo Site is presented in Appendix D.

Approximately 0.8 hectare (2 acres) of the total 3.24 hectares (8 acres) at the construction site was disturbed as a result of clearing the land for the antenna, its support pads, and the connecting roadway, waterline and cable tray. This had a likely, but minimal effect on any wildlife in the area.

Operation of the DSS 24 antenna also should have a minimal impact on wildlife because traffic on the access road, of about two vehicles per day, travels at a slow speed to keep collisions between vehicles and wildlife to a minimum.

1. The Desert Tortoise

JPL has constructed a fence around the DSS 24 antenna and its pad that keeps personnel within the site boundaries and keeps any desert tortoises from wandering under the antenna. Although the desert tortoise transects did not find any burrows on the 3.24 hectare site, the area may serve as a corridor for the movement of the reptiles.

In addition, all JPL personnel and construction workers at the DSS 24 antenna site were informed about the desert tortoise's federal threatened status and have been instructed to avoid any contact with the tortoise either personally or with automobiles or other vehicles. Signs are posted at the Apollo Site alerting personnel to leave desert tortoises alone.

2. The Mojave Ground Squirrel

The disturbance of the construction site also could affect the Mojave ground squirrel since the Cumulative Habitat Impact Analysis (Appendix B) showed that the site is a suitable habitat for this small mammal. As with the desert tortoise, all JPL personnel and construction workers have been informed about the Mojave ground squirrel's federal candidate threatened status and have been instructed to avoid any contact with the small mammal. Surface disturbance at the construction site was kept to a minimum.

B. EXPOSURE OF BIOLOGICAL SPECIES TO ELECTROMAGNETIC RADIATION FROM THE DSS 24 ANTENNA

The design and operation of the DSS 24 antenna are anticipated to result in a power density of less than 1 mW/cm^2 at ground level. Thus, exposure to electromagnetic radiation from the antenna at ground level is anticipated to be insignificant because of the low power-density levels.

Previous research concerning the bioeffects of microwave radiation indicates there are no irreversible adverse effects for either mammals or reptiles resulting from exposures to average power densities less than 2 mW/cm^2 . For average power densities greater than 2 mW/cm^2 , animals chronically exposed to

such power levels show either no effects or reversible noncumulative behavioral or physiological disturbances, even including immunological effects.

For a detailed discussion of the possible effects of electromagnetic radiation upon humans and animals see JPL Publication 87-4, *Environmental Projects: Volume 15, Environmental Assessment: Proposed 1-Megawatt Radar Transmitter at the Mars Site*, Jet Propulsion Laboratory, Pasadena, California, October 15, 1992.

The only biota that potentially could be affected by exposure to the main beam of the DSS 24 antenna are birds and other flying fauna (bats and insects). The maximum power densities encountered with the DSS 24 antenna's main beam, however, are anticipated to be similar to those emitted by the other antennas already operating at the GDSCC. The GDSCC antennas have operated continuously for more than 30 years without any evidence of any biological damage either to humans or animals due to electromagnetic radiation.

With respect to the exposure of birds to electromagnetic radiation, animal behaviorists and ornithologists have been using radar beams for more than two decades to study the migration, navigation and homing aspects of birds.

A bibliography concerning the environmental and biological assessments for the construction of the new 34-meter DSS 24 antenna at the Apollo Site is presented in Appendix E.

APPENDIX A

ENVIRONMENTAL, BIOLOGICAL, GEOLOGICAL, METEOROLOGICAL,
AND HUMAN/SOCIAL ASPECTS AT THE GDSCC

APPENDIX A*

ENVIRONMENTAL, BIOLOGICAL, GEOLOGICAL, METEOROLOGICAL, AND HUMAN/SOCIAL ASPECTS AT THE GDSCC

A. GEOLOGICAL SETTING

The GDSCC is located in the north central section of the Mojave Desert Province, a wedge-shaped, down-faulted block that is bounded by mountain ranges to the north-northwest and south-southwest (Sharp, 1972). The structure and topography of the Province are largely fault controlled (Norris and Webb, 1976). The Mojave Desert is bounded on the south-southwest by the San Andreas Fault. The San Andreas Fault, which is the principal fault of a northwesterly trending shear zone, is at least 600 miles in length with 350 miles of right-lateral displacement. The Garlock Fault, at the northern boundary of the Province, trends to the northeast and east and has left-lateral displacement.

Typically, the Mojave Desert Province is characterized by broad, flat plains with occasional low (1,000 to 2,000-ft high) mountains. The Goldstone area, situated within one of these low mountain areas, trends in the northwest-southeast direction (parallel to the regional structural trend). Elevations in the Goldstone area range from 2,895 to 4,491 ft above mean sea level (MSL). The GDSCC lies within a 70-square-mile internal drainage area that includes Goldstone Dry Lake, the largest of several dry lakes in the area. The elevation of Goldstone Dry Lake is 3,021 ft above MSL (Kieffer, 1961).

B. CLIMATIC CONDITIONS

The climate at the GDSCC is arid with characteristic wide ranges in daily and seasonal temperatures, as well as high variability of precipitation. Average annual rainfall is approximately 5.5 in. Recorded annual precipitation ranges from a low of 0.5 to a high of 15 in. Precipitation is typified by short-lived, high-intensity storms that may produce local flash floods. More than one-half of the average annual precipitation has been known to fall in a three day period, during which peak rainfall may be as high as two inches in one hour (Kieffer, 1961).

C. SEISMOLOGY

The Mojave Block is broken by several major vertical to near-vertical shear faults. The primary fault system in the GDSCC area trends northwest, from the southern boundary of the facility to the southern tip of Goldstone Dry Lake. This fault system follows the regional structural trend that is characteristic of that portion of the Mojave Desert Province south of the GDSCC, which roughly parallels the San Andreas Fault zone. The Goldstone area is located in a transition zone between the northwest-trending structural area to the south, and an east-west-trending structural area to the north that roughly parallels the Garlock fault. Minor faults in the Goldstone area trend in nearly all directions, the main directions being west, northwest, and north. The general

* This appendix is a revised version of Section V of JPL Publication 87-4, *Environmental Projects: Volume 10, Environmental Assessment: New 34-Meter Antenna at Apollo Site*, published January 15, 1990. The references cited in this appendix, as well as other documents, can be found in Appendix E of the present volume.

relationships between the two structural systems enclosing the Goldstone area are not known, but both systems are active, and neither predominates over the other.

The GDSCC, including the Apollo Site, is located within an area that has recently been reclassified from Seismic Zone 3 to Seismic Zone 4 (Uniform Building Code, 1988, International Conference of Building Officials, Earthquake Regulations, Chapter 23). A Seismic Zone 4 is defined as a zone close to major fault zones and is within an area susceptible to damage corresponding to a Modified Mercalli Scale Intensity VIII or greater earthquake. (The Mercalli Scale is an arbitrary scale of earthquake intensity, ranging from I for an earthquake detectable only with instruments, to XII for an earthquake resulting in total destruction.)

Two intersecting faults are located within 0.25 miles of the Apollo Site. An east-west trending fault has been mapped approximately 500 feet south of the operations building at the Apollo Site. A north-south trending fault is truncated by the east-west fault, and the intersection of the faults is approximately 1,000 feet southwest of the operations building at the Apollo Site. The structure of the north-south trending ridge located to the west of the Apollo Site appears to have been controlled by faulting along the north-south trending fault (CDMG, 1963).

It appears likely that the Apollo Site could be exposed to seismic shaking during an earthquake event. The potential exists for structural damage to occur at the site from an earthquake. The extent of damage would be a function of soil composition, design of the structures, and their joint response to seismic shaking (Engineering-Science, 1987).

D. LITHOLOGY

Table A-1 describes a generalized stratigraphic sequence of the Mojave Desert Province in the Goldstone area, giving maximum thickness of each of the units and a brief lithologic description. It should be noted that this is a generalized sequence and that at any given site some of the units may or may not be present or may or may not be present in the given thickness. The general stratigraphic data in Table A-1 were constructed from information obtained from Kieffer (1961).

E. GEOLOGICAL HISTORY OF THE GDSCC AREA

The following is a brief summary of the currently accepted interpretation of the geologic history of the Goldstone area (Kieffer, 1961, and Fife and Brown, 1980):

- (1) The Precambrian crystalline basement was formed through the accumulation of extrusive and intrusive igneous units and subsequent sedimentation on an evolving continental crustal plate. During late Precambrian and Paleozoic times, these rocks underwent folding, faulting and metamorphic recrystallization, and were later intruded by granitic (pegmatite) dikes (thin injections of molten rock).
- (2) Sedimentary units of the Rustic Formation were deposited within the Cordilleran geosyncline which had formed at the western boundary of the North American continental plate. The Cordilleran geosyncline was a complex of marginal and shallow marine depositional environments, along with island-arc volcanic terrains.

Table A-1. Generalized Stratigraphic Sequence in the Goldstone Area
(after Kieffer, 1961)

Series	Stratigraphic Unit	Maximum Thickness (ft)	Description
Quaternary (Pleistocene) ^a	Alluvial fan and channel gravels; lag gravels; and lacustrine deposits	300+	Composed of sand, cobbles, and boulders derived from intrusive and extrusive igneous rocks; alluvial fan and lag gravels moderately cemented in a caliche matrix. Lacustrine (playa lake) deposits are primarily silt and clay.
Quaternary (Pleistocene) ^a	Basalt Flow	^b	Vesicular olivine basalt; resistant to erosion, caps several ridges, dips gently north; offset by faults only in the south-east part of the area.
Quaternary to Tertiary	Conglomeratic Sandstone	^b	Overlies andesite south-east of Pink Canyon.
Quaternary to Tertiary	Black Glass Dikes	^c	General trend N70E, intruded andesite flows only; assumed they occurred near end of andesite extrusion.
Tertiary	Andesite Flows	1000+	Thick sequence of lava flows; composed of andesite, with porphyritic hornblende and plagioclase; flowed from several volcanic vents; very resistant to erosion.
Tertiary	Andesite Breccia	600+ (with Tuff)	Angular blocks of volcanic rock, set in a matrix of volcanic ash; variably resistant to erosion.
Tertiary	Andesite Tuff	600+ (with Breccia)	Volcanic ash that is welded; some pyroclasts; variable resistance to erosion.
Cretaceous	Jack Spring Quartz Monzonite	^c	Quartz monzonite pluton that extends over 85 square miles; relatively homogeneous; has an orthogonal fracture system and parallel jointing; resistant to erosion.

^a Deposition of alluvial and lag gravels and lacustrine deposits is believed to have begun during the Pleistocene Age. The olivine basalt is considered to be Pleistocene Age, but isotope dating to confirm the age of the basalt has not been conducted.

^b Maximum thickness was not reported in available source literature.

^c Thickness cannot be determined for this type of rock body.

(Table continues on page A-5)

Table A-1. Generalized Stratigraphic Sequence in the Goldstone Area
(after Kieffer, 1961) (cont.)

Series	Stratigraphic Unit	Maximum Thickness (ft)	Description
Paleozoic	Rustic Formation	^b	Sedimentary and meta-sedimentary units derived from fine-grained marine sediments; foliated and moderately fractured; containing occasional quartz veins with gold and tungsten.
Paleozoic to Precambrian	Granitic Complex	^c	Metamorphic and intrusive crystalline rocks; schists, gneisses, and granites highly fractured; low to moderate resistance to erosion.

^a Deposition of alluvial and lag gravels and lacustrine deposits is believed to have begun during the Pleistocene Age. The olivine basalt is considered to be Pleistocene Age, but isotope dating to confirm the age of the basalt has not been conducted.

^b Maximum thickness was not reported in available source literature.

^c Thickness cannot be determined for this type of rock body.

- (3) Sedimentary units of the Rustic Formation and older Precambrian basement units were metamorphosed (subjected to high pressures and temperatures) during the late Paleozoic and Mesozoic eras. East-west compression of the Cordilleran geosyncline produced metamorphism, folding, and thrust-faulting (displacement of older rock units on top of younger rock units) within sedimentary units deposited within the geosyncline. Although thrust-faulting appears to have been most intense during the late Paleozoic and early Mesozoic eras, the juxtaposition of Precambrian units over Tertiary terrestrial sediments indicates that thrust-faulting occurred as late as Tertiary time (Fife and Brown, 1980).
- (4) Magma (molten rock) of the Jack Spring Quartz Monzonite intruded the existing older rocks probably during Cretaceous time.
- (5) Uplift and erosion of the area occurred, and most Paleozoic and Precambrian rocks were eroded away.
- (6) A broad basin formed in Tertiary (probably Miocene) time. Volcanic deposits composed of ash tuffs and andesite breccias covered the basin floor in layers up to 600 ft thick. Up to 1,000 ft of andesite lava flows originating from several volcanic vents covered the ash flow and breccia deposits. Black glass dikes intruded into the andesite flows.
- (7) Conglomeratic sandstone containing clasts weathered from the surrounding mountains was deposited discontinuously on the andesite lava beds during Tertiary and Quaternary times.
- (8) The region was uplifted and extensively faulted in Late Tertiary and Quaternary times. Faulting during Late Tertiary and Quaternary times was primarily normal. Transverse faulting was associated with the development of the San Andreas and Garlock fault zones.
- (9) Olivine basaltic flows covered parts of the region during the Pleistocene era. Since deposition of the basalt, the area has been tilted slightly to the north and extensively faulted in the southern part of the region.
- (10) Alluvium was deposited during Quaternary time, including: dry lake bed sediments; low lying sand and gravel alluvium in the main valleys; gravel and boulder alluvial fans, lag gravels, and debris slope deposits; unconsolidated sand, gravel and boulders in stream channels; and windblown sand. The thickness of alluvial cover ranges from 0 feet on ridge crests and rock outcrops to 1,000 feet within the valleys.

F. TYPES OF SOILS AT THE GDSCC

The following four soil types described in accordance with the Unified Soil Classification System (USCS) occur at the GDSCC:

- (1) Poorly to Well-Graded Gravels (GP to GW) with variable silt, and sand derived from granitic rocks;
- (2) Poorly to Well-Graded Gravels (GP to GW) with variable silt, and sand derived from decomposing volcanic rocks;

- (3) Poorly Graded Gravels (GP) derived from earlier, dissected alluvial deposits and terrace gravels (includes lag deposits); and
- (4) Clayey Silt (ML) to Clay (CL) deposited in lacustrine (playa lake) environments.

Unconsolidated volcanic and granitic soils have medium to high porosity and permeability. Development of caliche layers (calcium carbonate cementing of soil layers), however, can greatly decrease the permeability of the soil.

Desert pavement (a residual layer of large soil particles left on the ground surface after the finer particles have been carried off by wind and water) has developed over virtually all soil surfaces. This layer is made up of lag gravels that protect the surface against further erosion. These gravels are often coated with oxides of iron and manganese, known as desert varnish, that give the surface a shiny appearance.

A study to define the engineering properties of the soils at the construction site at the Apollo Site was undertaken, and completed prior to the final site selection and foundation design. The study confirmed that soil properties at the Apollo Site are similar to those at the Venus Site, where, in July, 1973, a geological, geophysical, and foundation-engineering survey was conducted to determine the feasibility of constructing a 34-meter antenna (Pacific Soils Engineering, Inc.). The 1973 study concluded that good foundation support exists at the Venus Site, with bedrock within reach (approximately 20 feet below the surface) of the pedestal and instrument tower foundations for the subject design.

In addition, JPL studied the foundation designs of existing structures at the Mars Site that were similar to the one proposed for the Apollo Site. Based on these studies, the soil was found to be suitable for construction of the 34-m DSS 24 antenna.

G. WATER RESOURCES AND FLOODPLAINS

1. Water Resources

There are no permanent streams at the GDSCC. Surface water flow occurs only after intense rainfall periods, and the water quickly infiltrates into the dry desert soils or evaporates. During heavy rainfall, water reaches Goldstone Dry Lake, which becomes inundated for short periods. This intermittent water supply is inappropriate for domestic and other planned uses due to its high levels of suspended and dissolved solids and very short-term availability. The entire Mojave River Basin (which includes the GDSCC) draws its water supply from the Mojave River groundwater basin, which in turn is recharged by only two sources: rainfall and the Mojave River (Department of the Army, 1979).

The GDSCC receives potable water from a group of six wells located within the vicinity of Fort Irwin. These wells draw from the Bicycle Lake groundwater basin and from the Fort Irwin groundwater basin, which are subunits of the Mojave River Groundwater Basin. About 1,000,000 gallons of water are pumped monthly from Fort Irwin to the GDSCC.

2. Floodplains

The Federal Emergency Management Agency (FEMA) has not mapped floodplains for the Fort Irwin Reservation, including the GDSCC. Ninety percent of the area in the southeast desert of California, however, is classified as Zone D, in accordance with FEMA definitions. Therefore, the GDSCC is most likely to be classified as Zone D, an area of undetermined but possible flood hazard. In the desert environment, in general, high-intensity storms may produce flash flooding. The GDSCC, however, has not experienced flood-related problems in the past.

Two intermittent streambeds (dry washes) are located near the Apollo Site: a wash located several hundred feet to the north of the buildings at the site, and a much smaller wash located immediately south of the site for the new antenna. The wash located north of the Apollo Site provides drainage for most of the area upslope from the site, and appears to provide adequate diversion of drainage away from the operational areas. The small wash located to the south of the construction site appears to provide adequate drainage diversion of a small area upslope of the location of the new antenna. Since the initiation of operations at the GDSCC, damage to structures due to flooding has not been reported.

H. BIOTIC RESOURCES, ENDANGERED SPECIES, AND WETLANDS

1. Biotic Resources

The biotic composition at the site of the new Apollo Site DSS 24 34-meter antenna was determined from information compiled through field reconnaissance, supplemented by information obtained from the existing literature. The site was surveyed on foot by the MBGA project team on April 24, 1989. Weather at the time of the survey was cool, with temperatures of 74°F and moderately strong winds of 10 to 20 miles per hour.

The physical nature of the antenna site permitted a direct systematic examination of all terrain within its confines. Floral constituents encountered were recorded in terms of relative abundance and habitat type. Faunal constituents were determined through the use of field identification, combined with documented habitat preferences of regional wildlife species that, whether or not detected during the survey, are thought to include the site within their range. The overall biotic composition of the site was derived from this information.

2. Vegetation

The vegetation in the vicinity of the DSS 24 antenna site is typical of a diverse mid-elevation Mojave Desert creosote bush scrub community. The dominant plant species are creosote bush (Larrea tridentata), burro-weed (Ambrosia dumosa), goldenhead (Acamptopappus sphaerocephalus), burrobrush (Hymenoclea salsola), and brittlebush (Encelia farinosa). Other perennial plants which were present in high abundance included Nevada Mormon tea (Ephedra nevadensis), winter fat (Ceratiodes lanata), bladder sage (Salazaria mexicana), box thorn (Lycium andersonii), desert trumpet (Eriogonum inflatum), California buckwheat (E. fasciculatum), and Mojave indigo bush (Psoralea argemone). Some Joshua trees (Yucca brevifolia), jumping cholla (Opuntia bigelovii) and beavertail cactus (Opuntia basilaris) were also present. Annual species present at the time of the survey included pebble pincushion (Chaenactis carphoclinia),

desert aster (Machaeranthera tortifolia), fiddleneck (Amsinckia tessellata), red-stemmed filaree (Erodium cicutarium), and coreopsis (Coreopsis bigelovii). Grasses present included Mediterranean grass (Schismus arabicus), Indian ricegrass (Oryzopsis hymenoides), and big galleta (Hilaria rigida).

3. Wildlife

Based on field observations and literature search, the varieties of wildlife expected or observed to regularly occur in the habitats of the DSS 24 antenna site are described below. A complete list of expected and observed fauna is available from the GDSCC.

a. Amphibians and Reptiles. No amphibians have been observed or are expected, due to the absence of surface water at the construction site or in its vicinity. A variety of lizards and snakes are expected to occur in the project vicinity. Common lizards include the western whiptail (Cnemidophorus tigris), zebra-tailed lizard (Callisaurus draconoides), and side-blotched lizard (Uta stansburiana). Other reptile species found with some frequency throughout the creosote bush scrub community are the desert iguana (Dipsosaurus dorsalis), desert tortoise (Gopherus agassizii), common leopard lizard (Gambelia wislizenii), coachwhip (Masticophis flagellum), gopher snake (Pituophis melanoleucus), sidewinder (Crotalus cerastes), and Mojave green rattlesnake (Crotalus scutulatus).

Due to the low ambient temperatures at the time of the survey, no reptiles were observed at the DSS 24 antenna-construction site.

b. Birds. A number of bird species are expected to breed in the creosote bush scrub community within the vicinity of the DSS 24 antenna site. These include the black-throated sparrow (Amphispiza bilineata), Say's phoebe (Sayornis saya), Le Conte's thrasher (Toxostoma lecontei), mourning dove (Zenaida macroura), loggerhead shrike (Lanius ludovicianus), and horned lark (Eremophila alpestris). No breeding activity was observed, however, at the construction site.

Four species of raptors (birds of prey) may breed in the vicinity of the construction site, and may utilize the site to forage. Common barn owls (Tyto alba) nest in the crevices and caves found in butte faces and canyons. Red-tailed hawks (Buteo jamaicensis), which are more frequent in winter, may breed locally. Prairie falcons (Falco mexicanus) are an uncommon breeding resident in the area, nesting primarily on steep cliff faces, which are more frequent in the northern portion of the GDSCC. Golden eagles (Aquila chrysaetos) may also inhabit the area.

c. Mammals. Small mammals, most of them nocturnal, are common in the Mojave Desert. The long-tailed pocket mouse (Perognathus formosa), the deer mouse (Peromyscus maniculatus), Mojave ground squirrel (Spermophilus mohavensis), and desert wood rat (Neotoma lepida) are expected in the vicinity of the DSS 24 antenna site. Merriam's kangaroo rats (Dipodomys merriami) are likely the most abundant and widespread small mammal within the construction area. The black-tailed jackrabbit (Lepus californicus) and desert cottontails (Sylvilagus audubonii) are also common throughout the area.

Predators expected in the antenna construction area include the coyote (Canis latrans), kit fox (Vulpes macrotis), ringtail (Brassariscus astutus) and bobcat (Felix rufus).

4. Impacts Upon the Biotic Resources of the DSS 24 Antenna Site and Their Mitigations

Impacts to the biotic resources of the antenna site and its vicinity are expected to be minimal due to the small size of the area altered by the antenna construction and by its proximity to existing roads. Wildlife, for the most part in the form of small rodents, are permanently displaced from the antenna area, and population numbers would likely continue to be lower in the immediate vicinity of the antenna. This decline in rodent numbers may have a minor effect on predators foraging in the area. None of these biological impacts would be significant.

During construction of the new 34-meter antenna, efforts were made to disturb as small an area of vegetation as possible. The desert flora recovers very slowly, and unnecessary clearing would be visible for many decades.

5. Endangered Species

Several species present in the vicinity of the construction site have been given special recognition by federal, state, and local resource-conservation agencies and organizations due to declining, limited, or threatened populations, resulting in most cases from habitat reduction (see Tables A-2 and A-3). Sources used for determination of sensitive biological resources are as follows:

- (1) Wildlife: U.S. Fish and Wildlife Service (FWS) (1986), California Natural Diversity Data Base (CNDDB) (1987), California Department of Fish and Game (CDFG) (1980, 1986), Remsen (1978), National Audubon Society (NAS) (Tate and Tate 1982), and Bureau of Land Management (BLM) (1980).
- (2) Plants: FWS (1986), CDFG (1985), CNDDB (1987), and Smith and York (1984).

Species considered sensitive in other parts of their range but not in the California deserts are not included in this discussion. With the exception of the desert tortoise, no federally-listed threatened or endangered species were located at the antenna site, nor are any more expected to occur. Thus, few effects to federally-protected rare, threatened or endangered species occurred as a result of construction of the DSS 24 antenna.

No significant impacts to California-listed sensitive, rare, threatened, or endangered plant species resulted from construction of the antenna. The Mojave indigo bush has been listed by the California Native Plant Society (CNPS) as being of limited distribution; it is a Federal category III species (considered too widespread to warrant Federal listing). The loss of a few individual Mojave indigo bush plants, however, is not significant.

No significant impacts to State-listed sensitive, rare, threatened, or endangered wildlife species occurred as a result of construction of the DSS 24 antenna. The CDFG has listed the Mojave ground squirrel as threatened, and this species is known to occur at the GDSCC.

6. Wetlands

No wetlands in the form of springs, seeps, or streams are found in the vicinity of the construction site. No playas (dry lakes) or areas where standing water may accumulate during or after a storm are evident on or in the immediate vicinity of the DSS 24 antenna site.

Table A-2. Sensitive Plant Species that Potentially Could Occur
at the GDSCC^a

Species	Status		Habitat
	FWS	CNPS	
<u>Androstephium breviflorum</u> Small-flowered androstephium	—	2 ^b	Gravelly to rocky soils below 7,000 ft
<u>Astragalus jaegerianus</u> ^c Jaeger's locoweed	C2 ^c	1B ^d	Sandy to gravelly soils below 4,000 ft
<u>Chorizanthe spinosa</u> Mojave spiny-herb	C3 ^e	4 ^f	Same
<u>Cymopterus deserticolus</u> Desert cymopterus	C2	1B	Same
<u>Dudleya saxosa</u> ssp. <u>saxosa</u> Panamint dudleya	C2	4	Same
<u>Eriophyllum mohavense</u> Mojave eriophyllum	C2	1B	Same
<u>Linanthus arenicola</u> Sand linanthus	C3 ^c	2	Deep sandy soils
<u>Psorothamnus arborescens</u> Mojave indigo bush var. <u>arborescens</u> (<u>Dalea a.</u>)	C3 ^c	4	Same
<u>Sclerocactus polyancistrus</u> Mojave fish-hook cactus	C2	4	Rocky soils

^a Listing agencies/organizations:

FWS: U.S. Fish and Wildlife Service (USFWS, 1986).

CNPS: California Native Plant Society.

Note: The California Fish and Game Department has no listing for this area.

^b Rare or endangered in California, but more common elsewhere.

^c Federal Category 2 candidate in which a decline of the species is suspected. Insufficient data exist, however, to support a proposed listing.

^d Considered rare and endangered throughout its range.

^e Species is too widespread to warrant listing.

^f Species has limited distribution.

Table A-3. Sensitive Wildlife Species That Have Been Observed in the Vicinity of the GDSCC^a

Species	Status ^b				Habitat
	FWS	CDFG	BLM	NAS	
<u>Gopherus agassizii</u> Desert tortoise	C2 ^c	—	S ^d	—	Creosote bush scrub
<u>Aquila chrysaetos</u> Golden Eagle	—	SC3 ^e	PS ^f	—	Nests in cliffs; forages over creosote bush scrub
<u>Falco mexicanus</u> Prairie falcon	—	SC3	—	—	Same
<u>Athene cunicularia</u> Burrowing Owl	—	SC2 ^g	—	2 ^h	Nests in banks of washes and road cuts
<u>Spermophilus mohavensis</u> Mojave ground squirrel	—	T ⁱ	—	—	Creosote bush scrub

^a None of the listed species actually were identified at the project site during the MBGA survey.

^b Listing agencies:

FWS: U.S. Fish and Wildlife Service (USFWS, 1986).

CDFG: California Department of Fish and Game (CDFG 1980, 1985, 1986).

BLM: Bureau of Land Management (BLM, 1980).

NAS: National Audubon Society.

^c Federal Category 2 candidate in which sufficient data exist to propose species for listing as threatened or endangered.

^d BLM considers this species to be sensitive due to small population size, limited distribution, or threat from human activities.

^e State Species of Special Concern, List 3: species not in immediate danger of extinction. Small population sizes, however, warrant observation.

^f BLM-proposed sensitive species, pending the accumulation of sufficient data to support concern.

^g State Species of Special Concern, List 2: Species warrants active monitoring due to population decline.

^h NAS second priority species: Special concern due to observed decline in population.

ⁱ State-listed as threatened.

I. AIR RESOURCES

1. Meteorology

Climatic conditions at the GDSCC are those typical of high desert. Summers are hot and arid while winters are relatively cool with little precipitation and frequent strong westerly winds. Occasionally there are summer showers and thunderstorms that result in flash flooding. During the winter months, strong winds may occur and local dust storms often accompany the strong winds.

2. Air Quality

The project site is located in the Southeast Desert Air Basin (SEDAB), an area that complies with environmental limits for all primary air pollutants except ozone. Air pollutant emissions from the GDSCC are primarily from storage and use of hydrocarbon fuels, a spray booth and degreaser, Diesel-engine generators, and wipe-solvents.

Construction of the DSS 24 antenna did not substantially increase fuel consumption for heating purposes. An air-conditioning unit, to cool specific antenna equipment, was installed at the construction site. There are no plans to increase fuel consumption for other purposes or to add new equipment that would increase the present level of emissions. Thus, it is not anticipated that the construction and operation of the antenna will result in any significant impact on basin air quality from stationary sources.

There has been no substantial increase in mobile-source emissions as a result of the construction of the antenna, since daily vehicle usage has not increased as compared to previous usage, and none is anticipated as a result of operation of the antenna.

Emissions generated during site preparation and construction of the antenna and support structures primarily were from exhaust emissions from construction equipment and fugitive dust generated as a result of soil movement. These emissions were of short-term duration, and, for the most part were confined to the Apollo Site, resulting in an insignificant impact on local air quality.

J. HUMAN ENVIRONMENT

1. Land Use and Socioeconomics

The GDSCC is located within the Fort Irwin Military Reservation, a U.S. Army installation. The GDSCC is a 52-square-mile complex with an extremely low-density development. Because of its mission, the GDSCC is highly sensitive to physical and electromagnetic interference and thus requires large surrounding areas with minimal activity and development.

With Fort Irwin bordering the GDSCC on the north, east, and southeast, the potential for incompatible activities and actions exists unless both facilities operate in a cooperative manner. Of primary concern are the 20 to 25 "critical" and 35-40 "semi-critical" days per year when GDSCC transmissions require absolute freedom from physical and electromagnetic interference. While critical-day activities have not been violated up to this time, this is still an area of concern. Memoranda of understanding have been signed addressing the responsibilities of both Fort Irwin and the GDSCC.

The GDSCC, including the Apollo Site, is designated as Rural Conservation (RCN) in the County of San Bernardino General Plan (San Bernardino County, 1986). The RCN designation permits a variety of low-intensity land uses such as agricultural croplands, mining areas, national forest, wilderness, and residential units on minimum lot sizes of 40 acres. The area is zoned DL-40, restricting subdivisions to no less than 40 acres. The DSS 24 34-meter antenna at the Apollo Site is included in the GDSCC development plans and is consistent with the County's General Plan.

The DSS 24 34-meter antenna is compatible with existing uses at the GDSCC and complements and supports the existing Deep Space Network. The antenna was constructed in two phases. The foundation was constructed over a 6-month time span during the first phase; the antenna then was planned to be erected over a 9-month span during the second phase. The existing DSS-12 34-meter antenna at the Echo Site will be dismantled and removed from the GDSCC after completion of the new DSS 24 antenna.

The Apollo Site has full-time employees who exclusively support operation of the existing Apollo DSS-16 26-meter and DSS-17 9-meter antennas. The DSS 24 34-meter antenna and associated facilities required the transfer of employees from the Echo Site to the Apollo Site. No new employees will be required for operation of the DSS 24 antenna. Therefore, there is no anticipated long term socioeconomic impact from the operation of the DSS 24 antenna on GDSCC or regional demographics.

2. Vehicular Traffic and Circulation

Vehicular access to the Apollo Site at the GDSCC is provided via Covington Road, a two-lane, paved surface road. Covington Road intersects Goddard Road and runs south-southeast approximately one mile to the Apollo Site.

Total employment level at the GDSCC will not change as a result of operation of the DSS 24 antenna. Changes in traffic patterns have occurred but there is no increase to total local traffic. The DSS 24 antenna is located close to the existing Apollo Site infrastructures, and thus only required construction of about 400 feet of additional access road.

During construction of the DSS 24 antenna some temporary construction traffic did occur. The small number of trips, relatively short duration of construction activity, and low level of roadway usage, however, precluded any significant impacts to local roadways.

3. Noise

The GDSCC noise environment is typical of quiet desert locations. The sparsely developed complex and restricted airspace, which are required to minimize interference with communications, serve to promote a quiet environment.

Noise sources originating from the GDSCC include minor, intermittent surface traffic, occasional aircraft operations, and activities at remote GDSCC operating sites. Surface traffic and its associated noise impact are at a relatively low level with a total staff of only about 200 people at the GDSCC. Air traffic at the airport at Goldstone Dry Lake is limited to propeller-driven aircraft. Flights include three scheduled NASA flights per week and infrequent flights of military administrative personnel. Mechanical equipment in use at the GDSCC also contributes to the overall noise environment. Even the loudest of generators, pumps and other types of mechanical equipment present at any

particular site produce a highly localized noise impact, however, that does not extend more than a few hundred feet from its source.

Off-site noise sources include some minimal occasional disturbance by Fort Irwin military training exercises and military aircraft sonic booms. Since antenna operations are restricted during hours when troop maneuvers and military aircraft have scheduled operations, these noise sources do not have an adverse impact on the various NASA missions.

Over the short term, noise impacts at the construction site did involve additional construction traffic noise and noise from site preparation (earth moving and excavation), materials handling, fabrication, and erection of facilities. Since the project location is in a remote area with no noise-sensitive land uses within miles, short-term noise impacts were insignificant. Long-term noise generation can arise from the antenna mechanical system, engineering shop activities, cooling/ventilation systems, generators, and motor vehicles. Since the DSS 24 antenna is replacing existing comparable facilities and a staff of approximately the same size, there is no significant change to the existing noise environment.

4. Cultural Resources

An abundance of archaeological and historic resources exists in the Mojave Desert, and especially within the boundary of Fort Irwin and the GDSCC. Since access to these installations is controlled, only a few archaeological sites have been discovered and recorded. Fort Irwin has employed a resident archaeologist who has documented areas of archaeological, prehistoric, and historic interest as well as fossil areas within the Fort Irwin and GDSCC boundaries. A large area within the GDSCC has been designated as an area of archaeological and historic interest. This site is located in the northern portion of the GDSCC, in and around Goldstone Dry Lake, approximately 1 mile north of the Apollo Site. The Fort Irwin archaeologist had been requested to conduct a survey of the Apollo Site to verify that no archaeological or historic resources exist at the site.

5. Radio Interference, Electromagnetic Radiation, and Microwaves

The GDSCC operates several large, high-powered, microwave, ground transmitters used in deep space communications. These transmitters are capable of transmitting radiation ranging in frequency from 10 megahertz to 100 gigahertz. Transmission in this frequency range produces radiation potentially hazardous to persons working nearby. The power density in the direct beam may cause severe biological damage. The energy density in the feeding system is considered potentially lethal. Currently, DSS-14 (Mars Station) is the only GDSCC antenna that radiates high-power on a routine basis. The new DSS 24 34-meter antenna, located at the Apollo Site, duplicates the electromagnetic functions of the existing DSS-12 antenna at the Echo Site: reception in both S- and X-bands, and transmission in the S-band.

The Jet Propulsion Laboratory (JPL) has issued Safety Practice Bulletin 12-4-6 that sets standards for safely operating antennas during transmissions. The bulletin addresses exposure hazards, exposure limits, and procedures for ensuring that all safety precautions are taken prior to and during a transmission event. In addition, the bulletin contains a requirement that JPL Form 0284-S, Optional Safety Review, be completed prior to modification of an existing antenna or construction of a new radio frequency transmitter. This safety review has been conducted for the DSS 24 antenna. All safety procedures and practices were

performed prior to construction and have ensured that the DSS 24 facility meets safety standards.

High-power microwave transmissions also can generate effects at greater distances, potentially exposing aircraft to radiation. In accordance with standard practice, procedures have been established with neighboring military installations and the Federal Aviation Administration (FAA) to prevent exposure of aircraft to radiation levels greater than 10 mW/cm. These procedures include restricting the permissible angles of radiation and avoidance of the supersonic corridor, establishing a prearranged schedule for transmissions, and providing airspace avoidance contour plots to cognizant external agencies. By following prescribed policies and procedures for existing antennas, the GDSCC has maintained a record of safe transmissions since it began high-power transmissions in 1981.

During the project-planning phase for the 34-meter DSS 24 antenna, specific requirements were negotiated and coordinated with nearby military installations and the FAA. These requirements for operation of the DSS 24 antenna are much less restrictive than those already in place for similar antennas at the GDSCC, because no transmissions are expected for the new DSS 24 34-meter antenna at the Apollo Site.

6. Solid and Hazardous Wastes, Toxic Substances, and Pesticides

a. Solid Wastes: Goldstone operates one 10-acre, Class III solid waste landfill. The landfill, which is located at the Echo Site, is properly permitted. Only non-putrescible, non-liquid solid wastes are accepted for burial.

Materials generated by the dismantling of the DSS-12 antenna at the Echo Site are to be sold as parts or recycled to the greatest extent possible. Solid waste generated during this dismantling activity would not have a long-term effect on the solid-waste disposal capabilities of the GDSCC. Other adverse impacts from solid waste generation are not anticipated as a result of operation of the DSS 24 antenna because:

- (1) Additional staff are not required to operate the antenna.
- (2) Operation of the antenna is not anticipated to result in generation of quantities of solid waste that are greater than quantities generated by the existing DSS 12 antenna.
- (3) Types of solid waste generated are not expected to change from those generated at the present time.

b. Toxic Substances and Hazardous Wastes: The GDSCC does not store or use large quantities of toxic or hazardous substances. The substances used in greatest quantities are fuels and oils. Purchase of drummed liquids is kept to a minimum.

A new storage facility for hazardous materials and wastes was constructed at the Apollo Site in 1990. The new facility is similar to the new facility constructed at the Echo Site as described in JPL Publication 87-4, *Environmental Projects: Volume 9, Construction of Hazardous Materials Storage Facilities*, November 15, 1989. An illustration of the new, environmentally acceptable storage facility for hazardous material and wastes, as it now exists at the Echo Site, is depicted in Figure A-1.

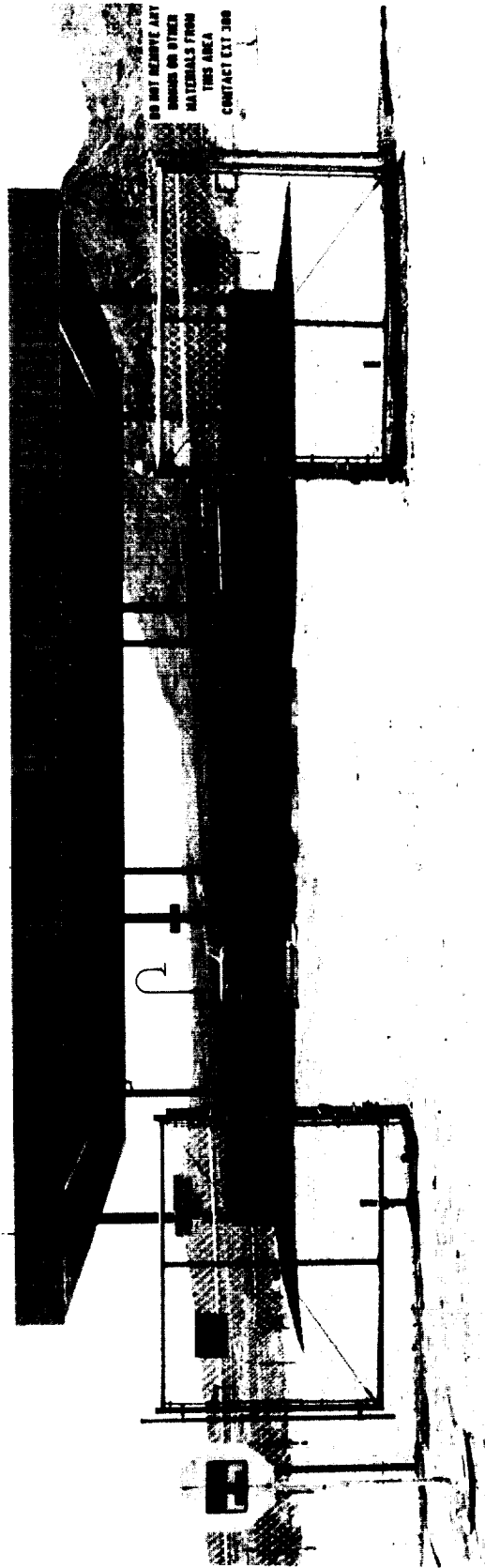


Figure A-1. Echo Site: Completed Storage Facility for Hazardous Materials and Wastes.
The New Hazardous Materials and Wastes Storage Facility Constructed
at the Apollo Site Is Similar to This Echo Site Facility.

Bulk products (primarily fuels and oils) are stored in permitted underground tanks in conformance with prevailing underground tank regulations. There currently are 13 underground tanks in use for storage of bulk fuels and oils at the GDSCC. All 13 tanks are of recent installation and are of double-wall construction with leak-detection systems.

Hazardous waste generated at the GDSCC is collected in drums at designated accumulation points throughout the complex. Accumulation points are maintained in conformance with procedures established by the GDSCC Environmental Office, and are inspected on a regular basis. Waste is transported from each accumulation point to a central staging facility located at the Echo Site. At this facility, all hazardous waste containers are readied for off-site transport to a commercial, permitted Hazardous Waste Management Facility for either treatment, recycling, or disposal, as appropriate. GDSCC policy requires minimizing waste generation and supports detoxification, reclamation, and reuse of wastes in preference to their disposal.

Materials to be stored at the Apollo Site to support the operations of the DSS 24 antenna are not substantially different in quantity or type from what is stored to support current operations. The waste-generation rate presently is very low (primarily oily waste), and also is not anticipated to be substantially different with the operation of the new antenna. Furthermore, the GDSCC has an active environmental program that includes routine monitoring of hazardous materials and waste management practices at each antenna station by the GDSCC Environmental Coordinator. Consequently, no adverse effects from hazardous substances are anticipated at the new DSS 24 antenna site.

c. Pesticides: The GDSCC does not directly purchase, store, or use pesticides. All pesticide application is by a licensed contract firm that brings spray applicators containing premixed pesticide to the GDSCC, applies the pesticide under the direction of the GDSCC's Environmental Officer, and leaves the premises with all remaining product and spent canisters. Virtually all pesticide application is to the interior of buildings. In the event that it is necessary to spray outside areas prior to initiating new construction, Natural Resource Management personnel from Fort Irwin or from the private sector are consulted to ensure that spraying will not affect environmental resources.

d. Summary of Hazardous Materials Use, Generation of Solid and Hazardous Wastes, and the Use of Pesticides at the New DSS 24 34-Meter Antenna at the Apollo Site: The Apollo antenna project does not require expansion over the current level of operations or an increase in workforce. Hazardous materials use, solid waste generation, or hazardous waste generation has not increased significantly as a result of the construction and is not anticipated to increase as a result of the operation of the DSS 24 antenna.

7. Health and Safety

The DSS 24 34-meter antenna design meets the health and safety standards of prevailing health and safety codes.

In accordance with the *Advanced Engineering Study Report for Design and Construction of a Beam Waveguide 34-Meter X-Band AZ-EL Antenna*, prepared by TIW Systems, 1986, safety provisions, similar to those required for the 34-meter antenna at the Venus Site, are provided for the DSS 24 antenna at the Apollo Site. Provisions include the following:

- (1) Lighting: Incandescent lighting is provided to give a minimum of five footcandles in all work areas. Battery-powered emergency lights

also are provided wherever frequent maintenance and service are required.

- (2) Grounding: The antenna is grounded and has lightning protection. All grounding and bonding conform to prevailing codes and good engineering practice.
- (3) Travel Limits: Redundant antenna travel limits are supplied at both limits of travel on each axis. Azimuth bumper contact switches also are provided on the azimuth access stairway structure to prevent damage around the antenna at ground level. Emergency stop switches are installed at the following locations:
 - (a) Elevation Drives
 - (b) Antenna Access Stairway
 - (c) Each Azimuth Drive Wheel
 - (d) Reflector Surface
 - (e) Lower Quadripod Leg.

No project-related health and safety impacts were involved in the construction of the DSS 24 antenna at the Apollo Site, and none are anticipated as a result of operation. A review of safety issues specific to operation of the antenna was initiated prior to the approval to construct the antenna.

8. Aesthetics

Typical views at the Apollo Site can be seen in Figures 5 and 6. The DSS 24 antenna site is approximately 1 mile south of Goddard Road and thus is not clearly visible to vehicle occupants traveling to the airport. The existing antennas and the location of the DSS 24 antenna are within a natural topographic bowl and thus are shielded from distant viewpoints. Although the DSS 24 antenna facility is approximately 30 feet taller than the existing Apollo DSS-16 26-meter antenna, no residential, commercial or public uses are located near the site. Therefore, the new antenna does not have an effect on area aesthetics.

K. BIBLIOGRAPHY

A bibliography concerning the environmental and biological assessments pertinent to the construction and operation of the new DSS 24 antenna at the Apollo Site is presented as Appendix E. This appendix includes the references cited in Appendix A.

APPENDIX B

CUMULATIVE HABITAT IMPACT ANALYSIS
FOR THE MOJAVE GROUND SQUIRREL
AT THE DSS 24 CONSTRUCTION SITE
AT THE APOLLO SITE

CUMULATIVE HABITAT IMPACT EVALUATION FORM

Name of evaluator Richard E. Fitzner; date trained 1 August 1992

Name of trainer/instructor for CIR Stephen M. Juarez

Location: Twp _____; R _____; Sec 3+4; 1/4 Sec _____

Date: _____

Site No. 1 (trapped? yes ☒, date trapped 6-8 Jan; no _____)
1992

OVERALL RATING 20

(CIR range: 0-40) (Ranking factors: 0-4)

LAND USE IMPACTS (0=none, 4=heavily impacted):

1. OHV use 2
2. Horse or foot traffic 2
3. Dog activity 0
4. Roads through area 3
5. Urbanization 3 (Apollo Site)
6. Garbage dumping 1 (litter scattered about)
7. Mining activity 0
8. Utilities 1 (underground - 2 lines)
9. Grazing and/or agriculture 0
10. Shrub disturbance 1

Average together the five most disturbed factors, then multiply by 10 for the cumulative impact rating (CIR). $10/5 = 2 \times 10 = 20$

GENERAL HABITAT DESCRIPTION:

1. SHRUB DENSITY ESTIMATE: high _____; medium ☒; low _____; (estimate % of each for 1/4 section) SEE Attached Biological Assessment.
2. Shrub species diversity: more than 6 ☒; 3-5 _____; 1-2 _____
3. Presence of annuals: A _____; B _____; C _____ See Biological Assessment
4. Presence of perennial grasses: A _____; B _____; C _____ See Biological Assessment
5. Presence of desert pavement: (estimate % coverage) SEE photos - Biological Assessment
6. Soil description: Coarse Sand, Gravel. Volcanic black rocks
7. Percent rocks and boulders present: (describe) Volcanic rocks scattered over the site 5-10%. Large rocks at east edge of site. See Biological Assessment photos
8. Presence of washes: 2 small Periodic flooding: yes.
9. Slope/Aspect: 5-6% / North 10. Elevation: 3100 ft.

Other Factors of Consideration:

Type of grazing allotment perennial _____; ephemeral _____ No Grazing
Proximity to known MGS population See Biological Assessment.
several nearby locations for MGS
Type of county zoning: NASA - GDSCC

Comments:

This site sits directly adjacent to the Apollo site, within 800 ft. This close proximity has resulted in more human activity than noted beyond 800 ft. Human evidence decreases the further away one walks from Goldstone.

APPENDIX C

DESERT TORTOISE DENSITY-TRANSECTS DATA SHEETS

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
Quad Goldstone Lake Alignment Sheet LINES 01, 2, 3, 4, 5

T 15N R 1E Section 3+4 Fraction NE 1/4 of 4
NW 1/4 of 3

	<u>Start</u>	<u>Finish</u>
Time	<u>0800</u>	<u>0815</u>
Location	<u>LINES 0-5</u>	
Temperature	<u>35 °F</u>	<u>35 °F</u>

Winds/Cloud Cover/other Winds - 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial FAN Slope Gentle

Aspect Gentle soil Type Coarse gravel Sand

* Bare Ground _____ Habitat Class # 1

Comments See Biological Assessment for biota description

Vegetation Type _____

HABITAT

- 1 - virgin
- 2 - grazing
- 3 - mining
- 4 - roads
- 5 - ORV use
- 6 - dump
- 7 - trails
- 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

SEE BIOLOGICAL ASSESSMENT

BIRDS

Rock WREN

MAMMALS

MAMMALS

Dipodomys burrows

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
Quad Goldstone Lake Alignment Sheet 6,7,8,9,10,11

T 15N R 1E Section 3+4 Fraction NE 1/4 of 4
NW 1/4 of 3

	Start	Finish
Time	0820	0840
Location	Lines 6, 7, 8, 9, 10, 11	
Temperature	35 ° F	35 ° F

Winds/Cloud Cover/Other Winds - 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial Fan slope Gentle

Aspect Gentle Soil Type Coarse gravel Sand

* Bare Ground _____ Habitat Class # 1

comments See Biological Assessment for biota description

Vegetation Type _____

HABITAT

- 1 - virgin
- 2 - grazing
- 3 - mining
- 4 - roads
- 5 - ORV use
- 6 - dump
- 7 - trails
- 8 - construction

PLANT SPECIES

PLANT SPECIES

HERP8

BIRDS

MAMMALS

MAMMALS

Coyote scat

Kut Fox digging?

Dipodomys Burrends

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
Quad Goldstone Lake Alignment Sheet 12, 13, 14, 15, 16, 17

T 15N R 1E Section 3+4 Fraction NE 1/4 of 4
NW 1/4 of 3

	Start	Finish
Time	0850	0915
Location	Lines 12, 13, 14, 15, 16, 17	
Temperature	37 °F	37 °F

Winds/Cloud Cover/Other Winds: 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial FAN slope Gentle

Aspect Gentle Soil Type Coarse gravel, sand

* Bare Ground Habitat Class # 1

Comments See Biological Assessment for biota description

Vegetation Type _____

HABITAT

- 1 - virgin
- 2 - grazing
- 3 - mining
- 4 - roads
- 5 - ORV use
- 6 - dump
- 7 - trails
- 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

SEE BIOLOGICAL ASSESSMENT

BIRDS

White crowned Sparrows

MAMMALS

MAMMALS

Coyote Seat

Dipodomys burrows

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
Quad Goldstone Lake Alignment Sheet 18, 19, 20, 21, 22

T 15N R 1E Section 3+4 Fraction NE 1/4 of 4
NW 1/4 of 3

	Start	Finish
Time	0930	0945
Location	LINE 18-22	
Temperature	37 °F	37 °F

Winds/Cloud Cover/Other Winds - 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial Fan slope Gentle

Aspect Gentle soil Type Coarse gravel Sand

* Bare Ground _____ Habitat Class # 1

comments See Biological Assessment for biota description

Vegetation Type _____

HABITAT

- 1 - virgin
- 2 - grazing
- 3 - mining
- 4 - roads
- 5 - ORV use
- 6 - dump
- 7 - trails
- 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

BIRDS

Raven - 2

MAMMALS

MAMMALS

~~Coyote Scat~~
Dipodomys Burrows

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
 Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
 Quad Goldstone Lake Alignment Sheet B-1, B-2, B-3, B-4, B-5

T 15N R 1E Section 3+4 Fraction NE 1/4 of 4
NW 1/4 of 3

	<u>Start</u>	<u>Finish</u>
Time	<u>0945</u>	<u>1000</u>
Location	<u>Lines B1-B5</u>	
Temperature	<u>37 °E</u>	<u>37 °E</u>

Winds/Cloud Cover/Other Winds 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial Fan slope Gentle
 Aspect Gentle Soil Type Coarse gravel, Sand
 % Bare Ground _____ Habitat Class # 1
 Comments See Biological Assessment for biota description
 Vegetation Type _____

HABITAT
 1 - virgin
 2 - grazing
 3 - mining
 4 - roads
 5 - ORV use
 6 - dump
 7 - trails
 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

SEE BIOLOGICAL ASSESSMENT

BIRDS

Rock Wren

Kestrel

MAMMALS

Dipodomys BURNSONS

MAMMALS

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
Quad Goldstone Lake Alignment Sheet B-6, B-7, B-8, B-9, B-10, B-11

T 15N R 1E Section 3+4 Fraction NE 1/4 of 4
Start Finish NW 1/4 of 3

	Start	Finish
Time	1000	1015
Location	Lines 36-B7	
Temperature	38 ° F	38 ° F

Winds/Cloud Cover/Other Winds - 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial Fan Slope Gentle

Aspect Gentle Soil Type Coarse gravel, Sand

* Bare Ground _____ Habitat Class # _____

Comments See Biological Assessment for biota description

Vegetation Type _____

HABITAT

- 1 - virgin
- 2 - grazing
- 3 - mining
- 4 - roads
- 5 - ORV use
- 6 - dump
- 7 - trails
- 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

BIRDS

MAMMALS

MAMMALS

Coyote Scat

Dipodomys Burrows

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
Quad Goldstone Lake Alignment Sheet 10 m Line

T 15N R 1E Section 3+4 Fraction NE 1/4 of 4

NW 14 of 3

	Start	Finish
Time	1030	1100
Location	10 m line around	Plot
Temperature	38 ° F	38 ° F

Winds/Cloud Cover/Other Winds - 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial FAN slope Gentle

Aspect Gentle Soil Type Coarse gravel, sand

* Bare Ground _____ Habitat Class # _____

Comments See Biological Assessment for biota description

Vegetation Type _____

HABITAT

- 1 - virgin
- 2 - grazing
- 3 - mining
- 4 - roads
- 5 - ORV use
- 6 - dump
- 7 - trails
- 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

SEE BIOLOGICAL ASSESSMENT

BIRDS

MAMMALS

MAMMALS

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
 Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
 Quad Goldstone Lake Alignment Sheet 100m Line

T 15N R 1E Section 3+4 Fraction NEL₄ of 4
 NW 1/4 of 3

Time 1100 Start 1100 Finish 1200
 Location 100m Line
 Temperature 38 °F 40 °F

Winds/Cloud Cover/Other Winds - 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial Fan slope Gentle
 Aspect Gentle Soil Type Coarse gravel, Sand
 % Bare Ground _____ Habitat Class # 1
 Comments See Biological Assessment for biota description
 Vegetation Type _____

- HABITAT**
 1 - virgin
 2 - grazing
 3 - mining
 4 - roads
 5 - ORV use
 6 - dump
 7 - trails
 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

SEE BIOLOGICAL ASSESSMENT

BIRDS

Rock Wren

MAMMALS

MAMMALS

Coyote Scats - 3

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
 Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
 Quad Goldstone Lake Alignment Sheet 200 m Line

T 15 N R 1 E Section 3+4 Fraction NE 1/4 of 4
 NW 1/4 of 3

	Start	Finish
Time	<u>1100</u>	<u>1200</u>
Location	<u>200 m Line</u>	
Temperature	<u>38 °E</u>	<u>40 °E</u>

Winds/Cloud Cover/Other Winds 0-5 mph, clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial Fan Slope Gentle
 Aspect Gentle Soil Type Coarse gravel Sand
 % Bare Ground _____ Habitat Class # 1
 Comments See Biological Assessment for biota description
 Vegetation Type _____

- HABITAT**
 1 - virgin
 2 - grazing
 3 - mining
 4 - roads
 5 - ORV use
 6 - dump
 7 - trails
 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

SEE BIOLOGICAL ASSESSMENT

BIRDS

Raven

MAMMALS

MAMMALS

Dipodomys burrows
Coyote Scats - 3-4
Coyote dig.

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
Quad Goldstone Lake Alignment Sheet 400 m Line

T 15N R 1E Section 3+4 Fraction NE 1/4 of 4
Start Finish NW 1/4 of 3

	<u>Start</u>	<u>Finish</u>
Time	<u>1100</u>	<u>1300</u>
Location	<u>400 m Line</u>	
Temperature	<u>38 °F</u>	<u>40 °F</u>

Winds/Cloud Cover/Other Winds: 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial Fan slope Gentle

Aspect Gentle Soil Type Course gravel, Sand

* Bare Ground _____ Habitat Class # _____

Comments See Biological Assessment for biota description

Vegetation Type _____

HABITAT

- 1 - virgin
- 2 - grazing
- 3 - mining
- 4 - roads
- 5 - ORV use
- 6 - dump
- 7 - trails
- 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

SEE BIOLOGICAL ASSESSMENT.

BIRDS

Rock Wren

Raven

MAMMALS

MAMMALS

Dipodomys Burrows

Coyote Scats

DESERT TORTOISE DENSITY TRANSECTS

Project Name DSS-24 GDSCC Date 8 January 1992
 Biologist(s) RICHARD FITZNER, BATTELLE PACIFIC NORTHWEST LAB
 Quad Goldstone Lake Alignment Sheet 800 m Line

T 15 N R 1 E Section 3+4 Fraction NE 1/4 of 4
 NW 1/4 of 3

Time 1100 Start 1330 Finish
 Location 800 m Line
 Temperature 38 °F 41 °F

Winds/Cloud Cover/Other Winds - 0-5 mph, Clouds 50-80%, Temp 32-42°F

SITE DESCRIPTION - General

Geomorphology Alluvial Fan slope Gentle
 Aspect Gentle Soil Type Coarse gravel, sand
 % Bare Ground Habitat Class # 1
 Comments See Biological Assessment for biota description
 Vegetation Type

HABITAT
 1 - virgin
 2 - grazing
 3 - mining
 4 - roads
 5 - ORV use
 6 - dump
 7 - trails
 8 - construction

PLANT SPECIES

PLANT SPECIES

HERPS

SEE BIOLOGICAL ASSESSMENT

BIRDS

Rock wren
Raven
Horned Lark - 2

MAMMALS

MAMMALS

Pack rat midden
Coyote scat
Coyote tracks
Dipodomys Burrows

APPENDIX D

CORRESPONDENCE BETWEEN JPL AND VARIOUS GOVERNMENTAL AGENCIES
CONCERNING THE BIOLOGICAL AND ENVIRONMENTAL ASSESSMENTS
INVOLVED WITH THE CONSTRUCTION OF THE NEW DSS 24 ANTENNA
AT THE APOLLO SITE AT THE GDSCC

December 12, 1991

Ray Bransfield
U.S. Fish and Wildlife Service
Ventura Office
2140 Eastman Site, Suite 100
Ventura, California 93003

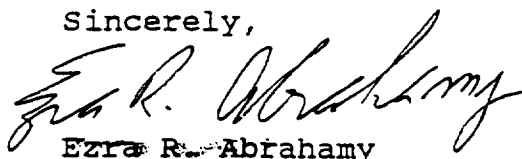
Dear Ray:

The Jet Propulsion Laboratory plans to construct two new microwave antennas at the Goldstone Deep Space Communications Complex (GDSCC) adjacent to Fort Irwin National Training Center. We are planning to construct the antennas in Sections 3 and 4, Township 15N, Range 1 East, San Bernardino County, California. The two proposed antennas would be situated at our existing Apollo site in GDSCC and adjacent to existing antennas and other structures.

In accordance with the Endangered Species Act, we are requesting a list of federally threatened or endangered species or proposed species or designated or proposed critical habitat that may occur within the area mentioned in the above paragraph. If you determine the area to potentially contain any threatened, endangered or candidate species, we will proceed with field inventories and the preparation of a Biological Assessment.

If there is a need for the preparation of a Biological Assessment, we would like to begin field studies by early January. Attachments are included which illustrate the project location and relationship of the two antennas to the existing site and its structures. Thank you for your assistance and support.

Sincerely,



Ezra R. Abraham

ERA:amm

cc: w/attachments:

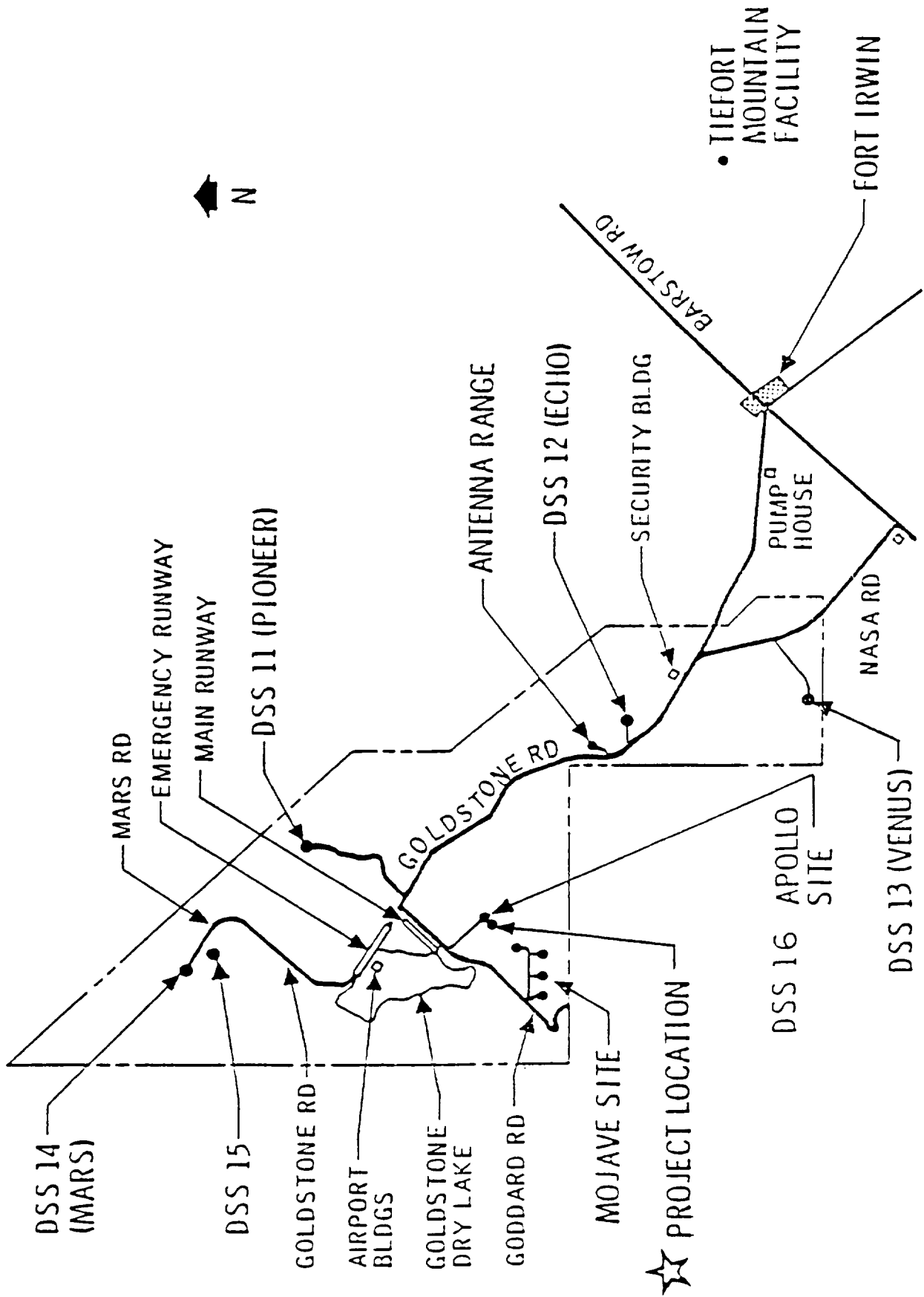
R. Fitzner, Battelle PNL
F. Hoover, CA Dept. of Fish & Game
K. McKee, CA Dept. of Fish & Game

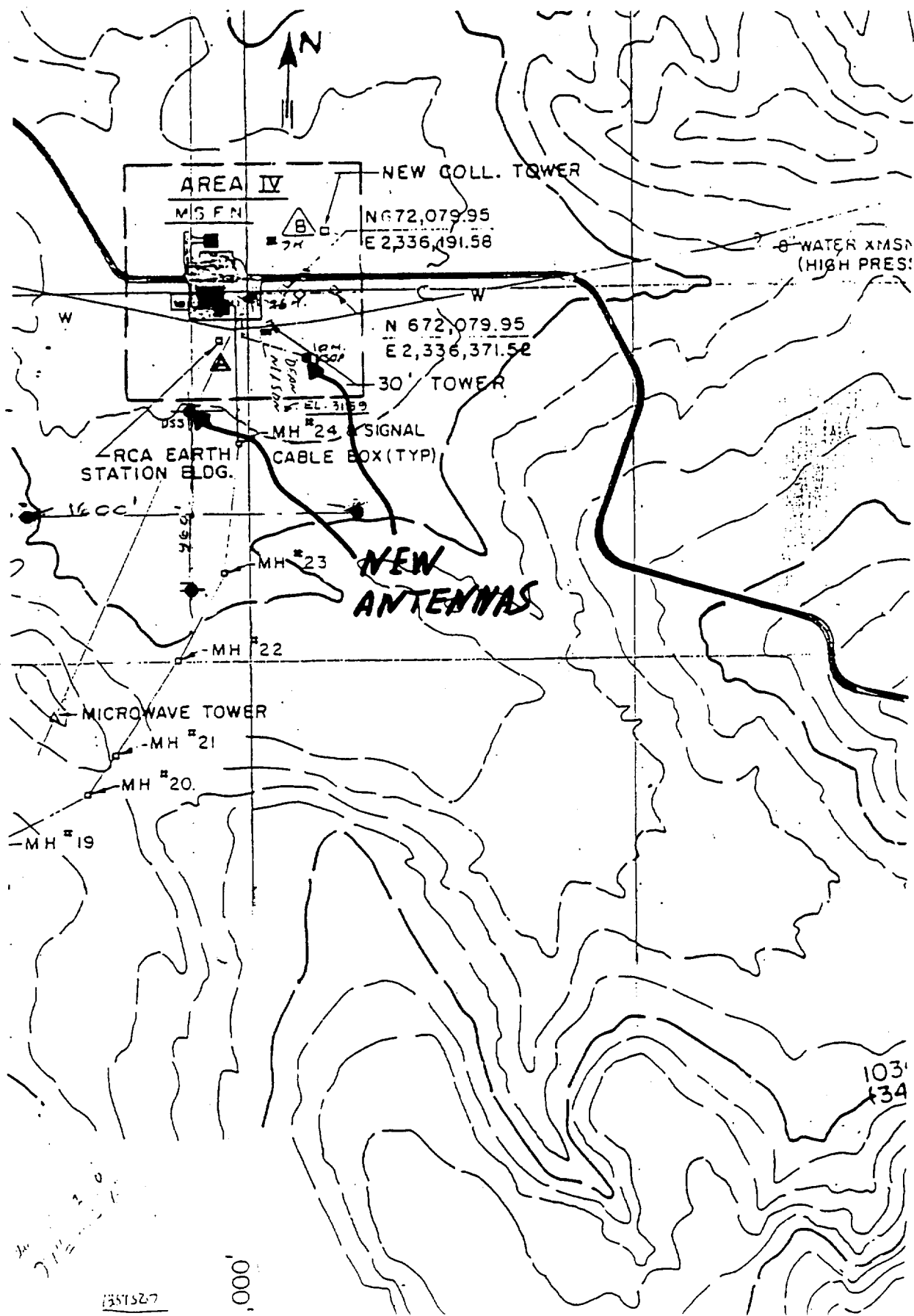
w/o attachments:

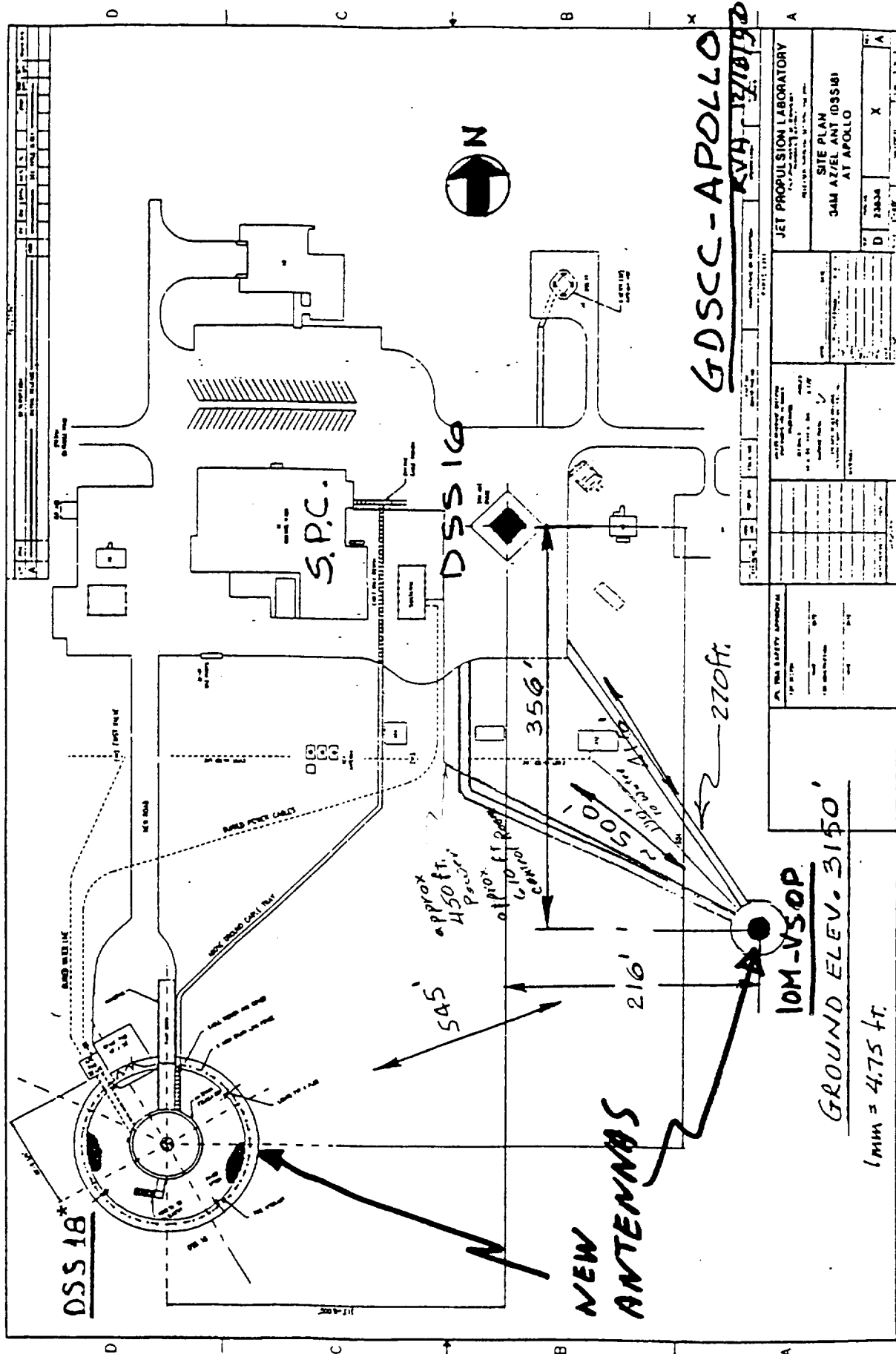
L. Kushner, JPL
G. Morris, JPL
J. Justice, JPL
R. White, JPL

CONSTRUCTION OF A 34M BEAM WAVEGUIDE REPLACEMENT ANTENNA

LOCATION PLAN, APOLLO SITE, GOLDSTONE, CALIFORNIA







★[The DSS 18 antenna is now known as DSS 24.--Editor]



United States Department of the Interior

FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE ENHANCEMENT
SOUTHERN CALIFORNIA FIELD STATION
Ventura Office
2140 Eastman Avenue, Suite 100
Ventura, California 93003

December 20, 1991

Ezra R. Abrahamy
Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, California 91109

Subject: Species List for Microwave facilities, Goldstone Deep
Space Communications Complex (1-6-91-TA-51)

Dear Mr. Abrahamy;

This is in response to your letter, dated December 12, 1991, and received by us on December 13, 1991, requesting information on listed and proposed endangered and threatened species which may be present in the vicinity of Goldstone Deep Space Communications Complex (GDSCC) adjacent to Fort Irwin National Training Center. If the construction of the two new microwave antennas at GDSCC may affect a listed species, the Federal lead agency has the responsibility to prepare a biological assessment if the project is a construction project which may require an Environmental Impact Statement. If a biological assessment is not required, the Federal lead agency still has the responsibility to review its proposed activities and determine whether the listed species will be affected.


During initial project assessment or review, the Federal lead agency may engage in planning efforts, but may not make any irreversible commitment of resources. Such a commitment could constitute a violation of section 7(d) of the Endangered Species Act. If a listed species may be affected, the Federal lead agency should request in writing through our office, formal consultation pursuant to section 7 of the Act. Informal consultation may be used to exchange information and resolve conflicts with respect to listed species prior to a written request for formal consultation.

Enclosed is a list of threatened and endangered species, taxa proposed for listing, and candidate species presently under review by the Fish and Wildlife Service for consideration for Federal listing. Only listed and proposed species receive protection under the Act. However, candidate species should be

considered in the planning process in the event they become listed or proposed for listing prior to project completion. Preparation of a biological assessment, as described in section 7(c) of the Act, is not required for candidate species. They are included for the sole purpose of notifying Federal agencies in advance of possible proposals and listings which at some time in the future may have to be considered in planning Federal activities. If early evaluation of the project indicates candidate species could be affected, you may wish to request technical assistance from this office.

If you have any questions, please contact Jim Rorabaugh of my staff at (805) 644-1766.

Sincerely,


Steve Chambers
Acting Office Supervisor

Enclosure

LISTED ENDANGERED AND THREATENED SPECIES AND
CANDIDATE SPECIES THAT MAY OCCUR WITHIN
THE VICINITY OF GOLDSTONE DEEP SPACE COMMUNICATIONS COMPLEX
FORT IRWIN, SAN BERNARDINO COUNTY, CALIFORNIA
1-6-91-TA-51

Listed Species

Desert Tortoise	<u>Gopherus agassizii</u>	T
-----------------	---------------------------	---

Candidate Species

Lane Mountain Milkvetch	<u>Astragalus jaegerianus</u>	2
Mohave Ground Squirrel	<u>Spermophilus mohavensis</u>	2

- (E) -Endangered (T) -Threatened (CH) -Critical Habitat
(P) -Proposed for Listing
- (1) -Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
- (2) -Category 2: Taxa which existing information indicates may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
- (3) -Category 3(c): Taxa more common than previously thought; no longer being considered for a listing proposal at this time.



January 30, 1992
Refer to: 401-009/IJJ:yjb

Mr. Richard S. Jirousek
Code OT
NASA Headquarters
Washington, DC 20546

Subject: Completed Environmental Assessment for the Planned 34-Meter Antenna (DSS-24) at Apollo (Previously Designated DSS-18)

Dear Dick:

The Environmental Assessment (EA) for the subject antenna DSS-24 (previously designated DSS-18) has been completed with the Finding Of No Significant Impact (FONSI).

NASA NHB 8800.11, page 3-21 (copy attached), Section i requires that upon FONSI determination, a brief statement be prepared for submission to a state or local A-95 clearinghouse(s) and/or prepared for publication in the Federal Register. Attached is a draft FINDING OF NO SIGNIFICANT IMPACT statement for your consideration and possible use. We would be happy to assist your office in this matter - in any way we can, particularly with the State of California Governor's Office of Planning and Research State Clearinghouse, and with the responsible local (area wide) clearinghouse which is the Southern California Association of Governments (SCAG).

A copy of the completed EA report is also enclosed. The report is JPL Publication 87-4, Environmental Projects: Volume 10, Environmental Assessment: New 34-Meter Antenna at Apollo Site, dated January 15, 1990. Section I, Introduction provides a summary of the proposed action with Section I.E containing the FONSI conclusion.

Please let us know if we can be of further assistance.

Best regards,

A handwritten signature in black ink, appearing to read "I. J. Justice".

I. J. Justice, Manager
TDA Resources and Safety

Enclosures

cc: E. R. Abrahamy (w/o enclosures)
P. T. Westmoreland (w/o enclosures)

and forwarded to the responsible Headquarters official in the form of a recommendation. Approval of the recommended assessment must be by that official, most simply in the form of a memorandum to the Associate Administrator for External Relations stating the conclusion regarding the need for an EIS, enclosing the approved assessment, and enclosing also a draft Notice of Intent (to prepare an environmental impact statement) or a draft Finding of No Significant Impact, as appropriate.

" (b) If the determination is that no environmental impact statement is required, the Headquarters official shall, in coordination with the Associate Administrator for External Relations, prepare a "Finding of No Significant Impact" (See § 1508.13 of the CEQ Regulations.) The "Finding of No Significant Impact" shall be made available to the affected public through direct distribution and publication in the Federal Register."

- i. ~~The Finding of No Significant Impact should Briefly~~ present the reasons why a proposed NASA action, which was the subject of an environmental assessment has been judged not to have a significant effect upon the human environment and, therefore, will not require the preparation of an EIS. It should consist of a brief summary of the environmental assessment (or the assessment itself, if it is appropriately brief). The Finding of No Significant Impact on actions which are state or local in scope shall be coordinated with the affected A-95 clearinghouse(s). The Finding of No Significant Impact on actions which are national in scope should be prepared for publication in the Federal Register. The public should be allowed 30 days to comment on the finding, and supporting information should be readily available on request.
- j. The responsible Headquarters official should prepare the finding and forward it to the Associate Administrator for

=====

DRAFT

=====

FINDING OF NO SIGNIFICANT IMPACT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
(NASA)

GOLDSTONE DEEP SPACE COMMUNICATIONS COMPLEX

APOLLO SITE

34-METER ANTENNA (DSS-24)

UNDER NASA PROCEDURES

14 CFR 1216.1 AND 1216.3, AND NMI 8800.7 AND NHB 8800.11

This Environmental Assessment addressees a proposal to add a parabolic dish antenna DSS-24 (previously designated DSS-18), to be located at the Apollo Site, Goldstone Deep Space Communications Complex. The proposed action is for a high performance, 34-meter wheel-and-track type, azimuth-elevation antenna. The action includes construction and installation of the antenna structure, a below-grade foundation and equipment enclosure, mechanical drive and controls, and optical elements. The Environmental Assessment has shown that construction and operation of the proposed antenna will not result in any significant impacts to the natural environment and will have minimal human environmental impacts. The infrastructure at the Goldstone Complex will not be affected by this project. After careful consideration of the information contained in the assessment, it is my determination that the impacts resulting from the proposed action will not have a significant effect on the physical environment nor the quality of the human environment. The preparation of an Environmental Impact Statement is not required. For further information and to provide comments please contact the undersigned. All comments must be received at NASA no later than February 28, 1992.

DATE: January 28, 1992

Margaret G. Finarelli
NASA
Associate Administrator
for External Relations

February 3, 1992

Mr. Jim Rorabaugh
US Fish and Wildlife Service (USFWS)
2140 Eastman Avenue, Suite 100
Ventura, CA 93003

Subject: Biological Assessment for the DSS-24 Antenna,
Apollo Site, Goldstone Deep Space Communications
Complex (GDSCC) (USFWS Reference 1-6-91-TA-51)

Reference: Letter (Guidelines) from Steve Chambers of USFWS to
Ezra R. Abrahamy of Jet Propulsion Laboratory
(JPL), dated December 20, 1991

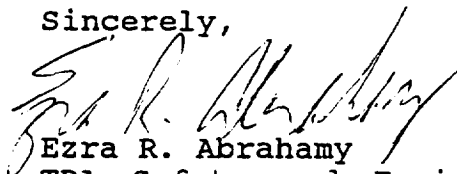
Dear Mr. Rorabaugh:

Attached is the subject Biological Assessment Report as prepared for JPL by Battelle, and dated January 24, 1992. The report is for your review and is marked "Limited Distribution..." and "Draft" for Battelle administrative purposes. However, the final report which will be forwarded to you for your records will be identical in content to the attached draft.

A letter for "Formal Request for Consultation" is being issued in order to help expedite the Biological Opinion. As you know, Desert Tortoise, Mohave Ground Squirrel, and Lane Mountain Milkvetch, were not found at the proposed antenna site.

Start of construction is scheduled for March 1, 1992 and your prompt Biological Opinion will be appreciated. Please FAX that opinion to my attention at FAX # (818) 393-6743. Please call me at (818) 354-1856 should you have any questions.

Sincerely,



Ezra R. Abrahamy
TDA Safety and Environmental
Protection CDE

ERA:amm
Attachment

cc:

W/Attachment:

Kimberly K. McKee, California Department of Fish and Game
Frank Hoover, California Department of Fish and Game

W/O Attachment:

Steve Chambers, USFWS
J. Justice, JPL
L. Kushner, JPL
G. Morris, JPL
R. White, JPL

CONFIRMATION COPY

JPL

SEND VIA FAX
FTS 983-6288

February 11, 1992

Mr. Steven M. Chambers
Office Supervisor
U.S. Fish and Wildlife Service
2140 Eastman Ave., Suite 100
Ventura, CA 93003

Dear Mr. Chambers:

Pursuant to 50 CFR Part 402.13 and informal consultation on this project, the DSS-24 antenna will not affect the desert tortoise and we seek your concurrence. To assure no effect to the desert tortoise, the following shall be included as part of the project:

1. Construction personnel shall be briefed on the status of the desert tortoise and protection measures designed to reduce potential impacts to this species. Personnel shall be advised that handling, harming, or harassing desert tortoises without specific authorization is a violation of the Endangered Species Act. Personnel shall also be advised of the potential penalties up to \$25,000 fine and 6 months in prison for taking a listed species without a permit. Signs shall be posted at the Apollo Site directing personnel not to disturb or collect desert tortoises.
2. The antenna facility shall be fenced in a manner to prevent access of desert tortoises to the site.
3. Overnight parking and equipment storage shall be located within the tortoise-proof fenced area, when possible.
4. The boundaries of the construction area shall be clearly flagged. All construction workers shall strictly limit their activities and vehicles to flagged areas to eliminate adverse impacts to desert tortoises and their habitat. All workers shall be instructed that their activities are restricted to flagged areas.
5. Overnight parking and equipment storage shall be contained within the flagged construction area. For vehicles parked outside the fenced area, workers shall inspect underneath any parked vehicles immediately prior to moving the vehicles. If a desert tortoise is beneath the vehicle, the vehicle shall not be moved until the desert tortoise has left on its own accord.

6. During construction, trash and food items shall be promptly contained in raven-proof containers, such as metal or heavy plastic containers with lids that can be secured, and removed daily from the project sites.
7. If a desert tortoise is found on the construction site, activities which might result in a take of the animal shall cease and the Service shall be contacted. The Service has not authorized incidental take, including relocating desert tortoises found in the construction area, for this action.

The above recommendations are the result of our informal consultation with your office and include Service recommendations. Your written concurrence is requested on our findings that the planned DSS-24 antenna action will not affect the desert tortoise.

Please call me at FTS 792-1856 if you have any questions.

Best regards,

Ezra R. Abraham (amm)
~~Ezra R. Abraham~~
TDA Safety & Environmental CDE

ERA:amm

cc: JPL:
J. Justice
L. Kushner
G. Morris
R. White

CA Dept. of Fish & Game:
F. Hoover
K. McKee

U. S. Fish & Wildlife Service:
J. Rorabaugh



United States Department of the Interior



FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
SOUTHERN CALIFORNIA FIELD STATION
Ventura Office
2140 Eastman Avenue, Suite 100
Ventura, California 93003

February 12, 1992

E. R. ABRAHAMY

FEB 18 1992

Ezra R. Abrahamy
Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, California 91109

Subject: Concurrence of No Effect on the Desert Tortoise,
DSS-24 antenna, Apollo Site, Goldstone Deep Space
Communications Complex, San Bernardino County,
California (1-6-91-TA-51)

Dear Mr. Abrahamy;

This is in response to your letter, dated February 11, 1992, requesting concurrence by the Fish and Wildlife Service (Service) on your determination that the subject project will not adversely affect the desert tortoise, a federally listed threatened species.

The project includes construction of the DSS-24 antenna on a 420-foot diameter concrete pad; placement of three 10 by 20 foot trailers; construction of support heating, ventilation, and air conditioning, and other support facilities; 280 feet of paved roadway; and a waterline. Total acreage disturbed by these features is 2 acres (Fitzner, R.E., J.L. Downs, and W.H. Rickard. 1992. Biological assessment for a proposed microwave facility (DSS-24), Goldstone Deep Space Communications Complex. Battelle, Richland, Washington.)



Surveys described in the project biological assessment indicate that desert tortoises are probably absent from the area to be disturbed, although some sign, including one carcass and 2 unoccupied burrows, were found 400 to 800 meters from the project area. The biological assessment does acknowledge that desert tortoises may use the project area, periodically.

Section 9 of the Federal Endangered Species Act prohibits "take" of any listed species. The definition of "take" includes to harass, harm, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Informal consultation between our offices resulted in the incorporation of seven stipulations, designed to avoid take of desert tortoises, into the project proposal. Because of the inclusion of these

stipulations, the small scale of this project, and the unlikelihood of encountering desert tortoises on the project site, we concur that implementation of this project will not adversely affect the desert tortoise and formal section 7 consultation is not required. If, however, a desert tortoise is found on the construction site, activities which might result in take of desert tortoise must cease. The Service has not authorized incidental take, including relocating desert tortoises found in the construction area, for this action.

If you have any questions, please contact Jim Rorabaugh of my staff at (805) 644-1766.

Sincerely,


 Steve Chambers
Office Supervisor

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM

3320-92-097

February 20, 1992

TO: J. Justice, L. Kushner, G. Morris, R. White

FROM: Ezra R. Abraham *ERA*

SUBJECT: Concurrence by the U.S. Fish and Wildlife Service (USFWS) of No Effect on the Desert Tortoise from DSS-24

Attached is the February 12, 1992 letter from the USFWS with the subject concurrence. This concurrence allows the DSS-24 antenna to proceed with construction and operations. The concurrence is subject to the stipulations of the attached February 11, 1992 letter to the USFWS.

ERA:amm
Attachments

SECTION 332

SEP 1 1992

August 27, 1992

Mr. Steve Chambers
Office Supervisor
Ventura Field Office
U.S. Fish and Wildlife Service
2140 Eastman Avenue, Suite 100
Ventura, CA 93003

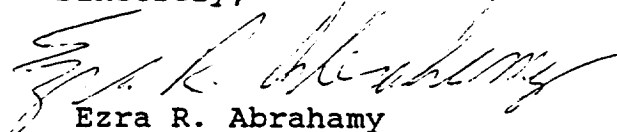
Subject: Biological Assessment, Final Version Report, for A
Microwave Facility (DSS-24), Goldstone Deep Space
Communications Complex

Reference: Letter from Steve Chambers of U.S. Fish and
Wildlife Service to Ezra R. Abrahamy of Jet
Propulsion Laboratory, dated February 12, 1992;
Subject: Concurrence of No Effect on the Desert
Tortoise DSS-24 Antenna, Apollo Site, Goldstone
Deep Space Communications Complex, San Bernardino
County, California (1-6-91-TA-51)

Dear Mr. Chambers:

Attached for your records is the final version report of the
subject biological assessment.

Sincerely,



Ezra R. Abrahamy
TDA Safety and Environmental
Protection CDE

ERA:amm
Attachment

cc: U.S. Fish and Wildlife Service
Ventura Field Office
2140 Eastman Avenue, Suite 100
Ventura, CA 93003
Attn: Mr. Ray Bransfield

U.S. Fish and Wildlife Service
Ventura Field Office
2140 Eastman Avenue, Suite 100
Ventura, CA 93003
Attn: Mr. Jim Rorabaugh

California Department of Fish and Game
4775 Bird Farm Road
Chino, CA 91709
Attn: Mr. Frank Hoover

California Department of Fish and Game
Region 5
330 Golden Shore, Suite 50
Long Beach, CA 90802
Attn: Kimberly McKee

JPL:

H. Alderson
F. Battle
J. Justice
L. Kushner
G. Morris
R. White

DEPARTMENT OF FISH AND GAME

330 GOLDEN SHORE, SUITE 50
LONG BEACH, CA 90802

(310) 590-5113

E. R. ABRAHAMY

OCT 13 1992



September 25, 1992

Mr. Ezra R. Abrahamy
Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, California 91109

Dear Mr. Abrahamy:

After review of the Biological Assessment for a Proposed Microwave Facility (DSS-24), Goldstone Deep Space Communications Complex, the Department concurs with the findings of the U.S. Fish and Wildlife Service that the project will not adversely impact the desert tortoise, a state- and federally-listed threatened species.

Please be aware that this correspondence does not constitute authorization to take desert tortoises. Take is defined in the Fish and Game Code as hunt, pursue, catch, capture or kill or attempt to hunt, pursue, catch, capture or kill. Extreme caution must be taken during any construction activity. Should any tortoises be encountered, to avoid take, the animals must not be disturbed or relocated. In the event a tortoise is discovered, please notify Frank Hoover, (714) 597-8235.

Sincerely,

A handwritten signature in cursive script, appearing to read "Fred Worthley".

Fred Worthley
Regional Manager
Region 5

APPENDIX E

BIBLIOGRAPHY CONCERNING ENVIRONMENTAL AND BIOLOGICAL ASSESSMENTS
FOR THE CONSTRUCTION OF THE NEW 34-METER
DSS 24 ANTENNA AT THE APOLLO SITE

APPENDIX E*

BIBLIOGRAPHY CONCERNING ENVIRONMENTAL AND BIOLOGICAL ASSESSMENTS FOR THE CONSTRUCTION OF THE NEW 34-METER DSS 24 ANTENNA AT THE APOLLO SITE

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* This appendix originally appeared as Appendix B ("Environmental Assessment: Bibliography") in JPL Publication 87-4, *Environmental Projects: Volume 10, Environmental Assessment: New 34-Meter Antenna at Apollo Site*, published January 15, 1990. Some of the items listed in this general bibliography are not mentioned in the text of the present volume.

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